PSYCHOPATHOLOGY AND SOCIAL PSYCHOLOGY

II. PERSONALITY AND ETHOS

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I. INTRODUCTION

What cements a social group together so as to make it an integrated unit? Intercommunication between the tissues of our bodies is accomplished by hormones and nerve impulses which are physiological agencies, setting up physiological responses. In a 'social organism', on the other hand, intercommunication can only be accomplished by signals which are perceived by the unit members of the group. These signals are seen, heard, smelt or felt on the surface of the body. As to their nature in different species we know little, but some observations show their astonishing specificity and mandatory influence. For instance, a wild elephant just captured and tethered, plunges frantically about until two tame elephants are led up to either side of him. The moment their flanks touch his he quiets down and will imitate their movements; he has received a herd tactile stimulus that coerces imitation.

Prods and grunts and cries probably constituted the signal system of man's ancestors, but with the growth of his cerebral cortex there came increasing intelligence and with it language—in what stages we shall never know, although some speculations may be more plausible than others. Language makes possible, or facilitates, group planning to meet situations not yet encountered, but it is also used to formulate the *reasons for behaviour*. So long as a creature is governed solely by instinct, individual habit and imitativeness, he can be an integrated member of a group while in contact with it; but, when isolated, he becomes either an individualist or else is as incapable as a sheep that panics when separated from the flock. In human societies there is division of labour, a division that necessitates at least temporary isolation of members from sensory contact with the group. If they carry in mind the 'reasons for behaviour', enshrined in herd formulae, they are not isolated mentally even though they are physically.

II. THE BASIS OF SOCIAL COHESION

'Reasons for behaviour', according to Trotter (3), fall into two categories: Rules for conduct and beliefs. One tribe is differentiated from others, or one culture from another, by what it considers right and wrong as well as by its 'philosophy'. Taboos evolve into conventions, laws and precepts; animism and magic evolve into theology, scientific theory and engineering or medicine, but fundamentally the differentia are the same—variations in moral code and peculiarities of theory on which adaptation is based. A savage tribe goes to war under the orders of its deity whose prestige must be defended or enlarged; a 'civilized' country goes to war to defend, or improve, its 'way of life'. When at war the veneer of universal moral standards is stripped off and group expediency is the accepted ethical touchstone. A savage,

believing in spirits that inhabit sky, water, earth, plants and animals, bases his actions on this theory, and is just as rational in this as is one of our engineers when he acts on the theory of electromagnetic waves. One theory may be easier to confirm experimentally than the other, but there are probably no more engineers engaged in challenging the validity of current physical theories than there are savages who question their daemonology. The science of one group may be more advanced than that of another, but the individual in one culture is as much in thrall to the creed of his people as is his cousin in another community.

The group, then, is the authority that decides what is morally right and decrees what is true or false, real or unreal, in the fields of religion and science. Even the amateur historian or anthropologist can adduce much evidence to validate this statement. On the other hand, it affronts the cherished conviction of every one of us, and is often contrary to experience. If John Smith refrained from stealing merely because there was a law or convention against it, then he would be morally in the same category as the criminal who had no qualms about stealing when he would not be detected. The individual conscience is a psychological fact. Again, although John Smith may say that he 'knows' the earth travels round the sun (thereby denying the evidence of his senses), yet some of his generalizations about nature are based on personal experience and logical deductions from events he has observed. Between what he accepts on faith and what he has proved, or could prove for himself, he makes no discrimination; both bodies of knowledge are lumped together and constitute his 'reality'.

It is to Trotter that we owe the clue which enables us to understand this paradox. In fact, his formulation is a key that unlocks many doors in social psychology. In brief it is this. The signal system, the 'herd voice' which serves to co-ordinate the actions of its members, is in the human group evolved into codes and beliefs. These are adopted by the individual because they symbolize *membership*—a membership that provides a feeling of comfortable security, while moral or intellectual independence is fraught with the perils of outlawry. But he begins, and remains, an individualist as well. A compromise is reached by his incorporating into his ego, his picture of himself, the morals and lore of his parents, teachers and companions; he makes them his own, calling them his conscience and his knowledge. As a social creature impelled to imitate his fellows, he does so instinctively and unconsciously by a process of 'rationalization'.* The essence of rationalization is that an idea or motive having unconscious roots is ascribed wholly to the conscious personality. There is, he says, an ultimate right and wrong of which his conscience is the judge; there is, too, an ultimate reality or truth of which his intelligence gives him some knowledge. Thus what he derives from his group he both generalizes and particularizes, protecting himself from the uncomfortable thought that he is just one of the 'dumb, driven cattle'.

Man, indeed, is not just a cog in a social machine; if he were our problem would be much simpler than it is. Actually every man's conscience is an individual structure. It has grown as a compromise between native self-seeking and the longing for harmonious relations with his fellows. We are, perhaps, dowered from birth with varying degrees of individuation. We are certainly exposed to different human influences. As a result each of us has a personal scale of moral, intellectual—and aesthetic—values; and that is why

* It was Trotter who introduced this term into modern psychology although its popularity is due to its fruitful exploitation by psycho-analysts.

social psychology is so complicated. We can say neither that human groups are composed of depersonalized robots nor that such measure of unity as they enjoy is due to co-operation on the basis of enlightened self-interest alone. Such simplifications lead only to doctrinaire follies. A more correct formulation would be that societies are cemented by loyalty to common ideals or objectives, a loyalty that perhaps springs ultimately from a biological urge to unanimity, but that the units thus integrated do not lose their identities. An Englishman, when he behaves like one thousands of miles from home, is betraying a loyalty to his country's way of life that has been incorporated into his nature from childhood on. But he is also moved by the enthusiasms and fears of his immediate companions. In a crowd he may abandon the moral and intellectual standards of a lifetime. A further complication is that we all of us belong to many different groups, professional, religious, political, recreational and so on. When we identify ourselves in turn with their objectives we tend to adopt, for the time being, the outlook of the group in question. It is notorious that many a man will countenance behaviour in pursuit of some communal aim that he would abjure in his private business—and vice versa. This, however, is only a tendency. Except perhaps when overborne by mob-madness, we do not change kaleidoscopically in our different social settings. On the contrary, every group is always under the influence of its more forceful and independently thinking members. In fact, any society that lacks people of character who think for themselves remains stationary or declines; our cultural evolution has resulted from following trails blazed by adventurers in science, the arts and ethics. Palaeontologists tell us that ants have not changed in countless millions of years; observers of their communal life to-day report no evidence to indicate that unconventionality is encouraged in their present societies. Insect colonies have apparently a static adaptation while it is man's destiny to evolve, and the keynote to this variability that has enabled him to dominate his environment—and perhaps lose control of himself—is that *the group does not exert a direct and complete control of its members but one that is modified by each member when he transmutes the group's mandate into his personal version of it.*

III. Group ideals

So far we have been describing societies as cohering just to preserve their identity. But many groups have some objective, an endeavour to reach some goal beyond common survival and the comforts of sociability. They are formed in order to achieve some programme relating them to the outer world, or else evolve such ambitions. We can speak of these goals as *group ideals.*

Two important features exhibited by those who devote themselves to the attainment of these ideals are altruism and a quasi-mystical belief in the immortality of the group. That schools, religious and charitable institutions should work for the betterment of others is natural, but what is surprising is the way in which a group formed simply for the benefit of its members—such as an economic one—may develop feelings of responsibility towards the outside world that have nothing to do with the primary objects of association and may even run counter to it. An example is a group of investors who pool their savings in order to manufacture some commodity in the hope of making money but with no other motive whatever. With this end in view they buy both raw materials and labour as cheaply as possible and sell their product for as much as they can. But soon two interrelated developments are apt to occur. First, pride in the quality of the product appears—a pride that demands a maintenance of the value to money ratio or an improve-

ment therein and that therefore reduces the profit that might be made. Secondly, the management—the investors—tend to develop an interest in the employees and their welfare, while the work-people in their turn participate in the *esprit de corps*, feel jealous of the company's reputation and become anxious to see it prosper. When this unity is achieved, management may keep the factory running in bad times for the sake of the employees, while the latter will accept lower wages than they could get elsewhere because they feel 'the firm will treat us right'.

This kind of development seems a frequent, if not invariable, phenomenon in economic groups which persist long enough to evolve traditions—the tradition being prone to denote responsibilities rather than ways of making money. A striking example of this is the evolution of motive and attitude in connexion with India. The East India Company was formed with frankly economic aims. As it grew in power, expedience—and perhaps not expedience alone—led to the Company taking over Governmental responsibilities. The latter then displaced the former in relative importance and the Crown became the legatee of the Company. Economic exploitation was transmuted into paternalistic Government in the nineteenth century. In the twentieth century the tendency to shift from 'Imperialism' to 'Democracy' has brought us to a point where the idea of getting a financial return for the service of the Government is regarded, in some quarters, as extortion by violence or by threat of force. This is, of course, an over-simplification of the history of the British Raj. But no study of all the cross-currents could eliminate the basic fact that economic ambitions have not merely been displaced from their original dominance but have actually become the object of censure.

Another example is furnished by the evolution of Trade Unionism. In this case, the direction of change is more indicated than proved, but for that reason is the more important to observe. Originally unions came into existence simply and solely to increase the bargaining power of the employee as against the employer, both operating within the framework of private capitalism. As local unions combined more and more into groups of nationwide distribution, political ideals began to appear. At first these were probably entirely, or almost entirely, economic in scope; that is, the ambition was to secure by legislation more advantages for the employees. But during this period doctrines were gaining ground which proposed an alternative to national economy based on private capital. These doctrines, generally labelled with the name of 'socialism', were espoused by the infant Labour Party. Since socialism aims at State control of all production and distribution of goods and services, a socialist party, if it came to power, would be responsible for the welfare of all citizens and not just of the so-called labour class. Further, the establishment of socialism would mean either the disappearance of the original Trade Union, the *raison d'être* of which would vanish with the abolition of the private-capital framework, or else it would survive as an organization striving for preferential treatment from the Government for its members. The inevitability of these alternatives does not seem to have engaged the serious attention of the leaders of either the Labour Party or of the Trade Unions.

But social evolutions go on whether they are observed or not. If, when in 1899 the super-union, the Trades Union Congress, gave birth to an independent political labour movement, it had transferred all its political interest to the Labour Party, mixed motives would not now be confusing the issues before the union leaders. Instead of that the T.U.C. has maintained its political interests, and inevitably has developed a feeling of responsibility

for the welfare of the country as a whole that cuts across the primarily sectional interests of trade unionists. This certainly looks like an abandonment of the primary aim of trade unionism—class aggrandisement. But for this evolution to be successful the leaders must carry the rank and file with them in following the new ideal. Here, however, we are confronted with the other side of the picture, with phenomena which show that the primary motives have by no means been abandoned and are, indeed, so strong that the issue is much in doubt. We have had a crop of 'unofficial strikes'. The men who lead the 'outlaws' complain that the officials of the big, national unions have got out of touch with local conditions and so they have to take the law into their own hands, so to speak. The accounts one reads of these affairs lead one to suspect at times that they are nothing but 'racketeering', but others seem perhaps to justify the complaints of the local groups that the heads of big officials are in the clouds. But whether the outcome is going to be a regression to the 'bad old days' of alternate strikes and lock-outs, or whether we are drifting towards a dictatorship control of labour, there can be no doubt that the programme of big unions has been complicated by the emergence of ideals referring to a much bigger world than that envisaged by the original bargaining groups.

Such ideals have two characteristics reminiscent of religion, and of extreme importance in understanding the behaviour of groups which espouse them. The first is that loyalty is transferred from the immediate welfare of the faithful to the strengthening of the 'cause'. The doctor works to banish disease which, were he successful, would deprive him of his livelihood; the scientist works not for his salary but for his science; the soldier accepts the risks of deformity or death; the nation which has evolved what it regards as the best system of government wants to give it to the world. The second characteristic is that the ideal, as something belonging to more than those who at the moment uphold it, is felt to be the common possession of those who lived in the faith generations agone and of those who will in future be born into the faith. The group ideal is immortal, so identification with it confers immortality on the believer. This is perhaps the essential component of the highest types of morale.

Every enduring group evolves ideals of this kind and, indeed, its permanence depends on them. The relation is reciprocal. The larger the membership—traditionally, currently and in the imagined future—the greater is the power in which the individual can participate by identification of himself with the whole. He gains this sense of immortality by serving the ideal. So the ideal must be something which inspired our forefathers, makes our own efforts fruitful, and will be realized only at some time in the unmapped future. Without these qualities it cannot command the requisite large membership. Who can, or could, formulate such a communal aspiration in specific terms? The answer is, of course, nobody. In other words *the group ideal is never formulated precisely*; it is an unconscious pattern which guides activity, which makes one action seem right and another wrong. It is like love which no man can define but everyone can feel. It is expressed in temporary objectives which arouse enthusiasm or in antipathies; in the worship of some traditions and the stamping out of others. All these foci for positive or negative actions are symbols. A potent group ideal is an endeavour, a journeying towards an unseen goal, a sense of direction. If it can be specifically defined, a set programme is adopted which is either successful or fails. In either event the quest ends. On the other hand, were there no symbols, no activities to be followed in the name of the ideal, there could never be any feeling of progress towards the goal, the journey would seem to be merely a wandering on

an uncharted sea. Hence the derogatory sense in which we use such words as chimaerical, mystical or Utopian when we apply them to political aspirations.

Now we all of us belong to many different groups; at one time we are co-operating with one set of companions or serving one group ideal, while at another we are involved in quite different pursuits. To employ a chemical parallel, the various social organisms are like the various plants and animals which in turn build into their tissues atoms that are exchanged from one to another. Three corollaries to this proposition follow naturally. The nature of any group will be modified by the personal characteristics of its members; membership in societies that cultivate particular interests is bound to be limited to those capable intellectually or temperamentally of appreciating the activities of the society; and, finally, since groups are always in competition for the services of their members, that group will dominate which has ideals most widely dispersed in the population.

Examples of these come readily to mind. Animals might band themselves together, but their union would be unlikely to eventuate in philanthropic projects. Men of science, art or literature form groups of international distribution, but their total numbers are small because there are in any country so few who take a passionate interest in these subjects. The best examples of dominant groups are religious or national ones. In the Middle Ages Europe was peopled by folk practically all of whom subscribed to the same or similar faiths. Everyone's life was affected by church observances, everyone's character was moulded, in part at least, by Christian principles. Here was common ground where all could meet, a common bond which all accepted. He who refused a call in the name of religion elected to be a pariah. No wonder that politics were largely ecclesiastical and that trade guilds were half religious. In modern times religion has lost this universality—except perhaps among Moslems and Hindus—and in its place has come nationalism. It is the nation that stamps its character on its citizens—it is easier to tell from his behaviour whether a man is an Englishman than whether he is Church of England, nonconformist or agnostic. It is national values the acceptance of which gives the citizen a feeling of communion with his mates, and it is these values for which he is prepared to die. If a situation arises to-day where faith and patriotism conflict (as recently in Germany), there are few who cannot find an excuse for obeying the call of 'country first'. Crusades were as natural in the Middle Ages as great wars are to-day.

That man would be a strange creature who enjoyed the society of any one coterie and who was completely satisfied with serving the interests of only one group. How then does he distribute his time and service? Two principles operate here apparently.

The first may appear to be tautological but is not entirely so. Each one of us is the kind of person he is because of the nature and proportion of the various interests he has. Each interest represents something that is not only personal but is the service of a group, real or imaginary (a creative artist or philosopher may produce something that he expects to have accepted only by those as yet unborn). A man is known by the companions he keeps, we often say. Another way of putting this is that he apportions his time to the different groups to which he owes allegiance in proportion to what he considers their relative merits. This may be tautology, but it is not quite so when we remember that social pressure has been a large influence in shaping his personality. In other words, through its imprint on its members, every community tends to fix the relative status of different activities. For instance, Welshmen spend a good deal of time in singing. This is not because every individual Welshman likes music but because he was brought up to like it; singing is

a Welsh community bond. Thus the weighting of the relative importance of the various activities within a community tends to be cumulative, and the peculiarity of any community is the product or expression of this scale of values.

The second principle has to do with external rather than internal factors. The interest which a man has in the activity of some one of the groups to which he belongs may be challenged by the situation in which the group finds itself. The situation is one of threatened extinction or of special opportunity. The affairs of a club, a church, a union, a school or a charity are in a bad way, the members are warned of the danger; many of them sacrifice other interests, for the time being, to rebuild the crumbling structure. Or, equally, an opportunity for expansion arises and there is a similar flocking to the colours. In this second case, if the venture is a success, the service will be maintained at a higher level as a result of the recruiting of new members attracted to the expanding enterprise. When this occurs, as it often has in the fields of economics, religion or politics, the complexion of society as a whole is changed.

IV. Ethos

We see, then, that the special characters possessed by large communities, such as nations, reflect the varied interests of their subgroups and the proportionate representation of these interests in the activities of the nationals. But these competing interests do not constantly chop and change like the colours in a kaleidoscope. All the subgroups are integrated into a whole that is the peculiar national culture, its 'way of life'. This is an overriding pattern that tends to control all the units. Any marked and sudden divagation from it arouses a national feeling of disquiet. On the other hand, a gradual change is gradually accepted so that the overall pattern is modified. The best term for this pattern is, perhaps, *ethos*.*

An important characteristic of the ethos is that it cannot ever be formulated in set terms. This is for two reasons. First, because it is the product of the interaction of innumerable individuals and many groups, each of whom is conscious of its particular aspiration. There is no 'average man' who knows what is eventuating from the interaction of all the elements. Secondly, as Harding (2) has argued so cogently in his interesting discussion of public opinion, what I am calling the ethos of the community is never a static configuration but is constantly in flux. A movement that is going eventually to impress itself on the total pattern begins in one intellectual, political, religious, economic or caste group and is well advanced there when it is only beginning to penetrate the generality; by the time it is widely accepted the initiating class may have abandoned it in favour of some other view.

Clearly what we are discussing is an evolution. But what of revolution? Can it not suddenly change the complexion of a country? Superficially this seems to be true, but on longer view the effects of revolution seem to be slighter than at first sight. A new government may promulgate laws and regulations that differ widely from those that the new junta has displaced, but this guarantees no change in ethos. Revolutions may occur in two settings. In one, government is traditionally in the hands of some ruling clique which the people as a whole accept as a necessary evil; only the politicians are politically minded, so a change of government is a change that does not alter the *Weltanschauung* of the average citizen. In the other setting, a people that has been accustomed to some measure of political thinking and responsibility is, as a result of a *coup d'état*, placed

* This term was introduced by Bateson (1).

under a government which tries to make the country something different from what it was. We have seen in our time how futile or transient are the effects of these revolutions. Mussolini tried to make Italians into a war-like people. Did he succeed? In Russia, the Bolshevik Government displaced the Czar's autocracy and have produced another bureaucracy likewise relying on secret police for the suppression of disaffection. Religion was outlawed, but it is again re-established and, as of old, the Church seems to be a political instrument as well as a congregation of the faithful. The so-called democracy in Germany under the Weimar Constitution failed because Germans simply could not work a system so foreign to their habit. So the Nazis stepped in and carried on, with accelerated tempo, the predatory policy originally begun by Frederick the Great.

This is not to say that revolutions have no effect on the outlook of the populace in countries where they occur. Of course the people as a whole are affected, but never to the degree that appears on the surface. The most effective method of change is the liquidation of a class that previously has been dominant in moulding public opinion. This leaves the masses, who always had been followers rather than initiators, as apparently plastic wax in the hands of the usurpers. But, where there has been an upper class to which the people as a whole have turned for guidance, the ethos of the country includes such a class and, if a particular group of representatives of that class is annihilated, the gap is felt and filled. The responsibilities and privileges of the departed are thrust on substitutes who reconstitute the old stratum. If they can really fit into the costumes of the old aristocrats, no change in the ethos has occurred. If they bring differing abilities and an inherently different outlook some change does occur. But only a slight one, for, if the new would-be dominant group is flagrantly different from the old, essential traditions are outraged and the people will have none of it. The brief seventeenth-century commonwealth served only to confirm the Crown as an essential component of what we now call British democracy.

It looks as if ethos was tolerant of slow, evolutionary change but was resilient to revolution. This is not surprising when one considers how it grows up as a mass of interlocking traditions and ambitions fused into a plastic unity. If there were no consistency from one year to the next there would be no true national unity and the group would be a temporary one, an artificial aggregation held together only by such police powers as the administration could command.

V. Personality and ethos

These generalizations about group ethos can be carried over directly to individual personality. The elements that are fused to make personality are the various interests of the subject.

The spontaneous behaviour of animals is determined by 'drives' which may be viewed as appetites arising mainly, if not wholly, from chemical changes in the body. These cravings force the animal into actions the result of which is the quieting of the appetite—if the behaviour is successful. Innumerable laboratory and field observations demonstrate that animals can build up elaborate habits of reaching their goals, and the more intelligent the creature the more complicated can the behaviour become. Naturally in such cases the bulk of what the animal does is not associated with actual satisfaction of the appetite, but the total train of behaviour is actuated, energized by the appetite. For instance, a carnivorous animal may spend hours or days in hunting during which only minutes may be occupied by actual eating. But all the antecedent exertions were rendered urgent by

hunger and qualified by it. A trained observer viewing the behaviour of many an animal can make a good guess as to whether the inner stimulus driving it on is hunger, sex or a craving to make contact with its herd.

At the human level a great change has occurred. Not only have programmes of activity become vastly more complicated, but they are based on planning as well as on habit. When planning occurs an unsatisfied appetite provokes imaginary schemes of satisfaction which are criticized, still in imagination, for their feasibility or uselessness. The actual or immediate environment offers no satisfaction, so a plan is made either to move to another environment or to modify the present one so that satisfaction is possible. This modification of existing circumstances involves no behaviour that is appropriate to immediate satisfaction, but it is motivated by thought of ultimate attainment of the goal and thus gains the alluring quality of the goal. This transference of value is fundamental and is characteristic of human mental life. (There are traces of it in apes.) For example, a man may be hungry and unable to obtain food without money. To get money he must work at some task that, of itself, provides no nourishment whatever. But he transfers the value of food to his job, he becomes, as we say, interested in it. The vast bulk of human activities are thus determined. We spend little time in the satisfaction of crude drives that express any basic animal needs. We are engaged, rather, in following interests—professional, recreational, social and so forth—that have grown up as symbols—sublimations, the psychoanalysts would say—of our biological drives. The human being, then, is living on a different psychological level from that of the animals.

But the animal, so to speak, is always there and, indeed, is performing an important role. Every interest is rooted in a primitive drive or, because elaborate interests involve such varied activities, in a number of primitive drives. The excitement of any biologically significant reaction is likely to arouse emotion—crude emotions like fear or anger. Apparently the excitation of the bodily processes such as occurs with what William James called the 'coarser emotions' provides the urgency, the energizing element, of thought or behaviour with an affective tone, while the *quality* of an emotion is determined by the nature of the behaviour or ideas that occupy conscious attention. Thus the refined aesthetic pleasure which a beautiful grouping of words may give can only be described as what James called a 'finer emotion'. Although quite different subjectively from a feeling of lust or panic, it may be accompanied by a bodily thrill that gives it intensity—a phenomenon noted by innumerable observers. So far as physiological investigation has gone, it seems that these visceral reverberations are undifferentiated disturbances. Quite similar bodily changes occur with emotions that are, either objectively or subjectively, entirely different.

Every interest has probably its characteristic emotional tone, although it may be so dilute as to 'fade into the light of common day' and be unremarked until its absence makes its prior existence evident. For instance, in depressive 'unreality states' the patient complains that the life, the reality, has departed from experience, thought and action. All existence is colourless, an emotional contact with the world is lost:

> It is not now as it hath been of yore;—
> Turn whereso'er I may.
> By night or day,
> The things which I have seen I now can see no more.
>
> . . . . . .
>
> But yet I know, where'er I go,
> That there hath past away a glory from the earth.

What is a 'glory' for one man may be a faint glow for his neighbour, while the latter is inspired by something that may promote little enthusiasm in the poet. These differences are apparently based on the degree to which a conscious preoccupation rests on unconscious 'complexes' which, in turn, are being reinforced at a bodily level. Thus an interest associated with livelihood has roots connecting it with a primitive struggle for existence, with brutish lust for power or fear of extermination. Domestic interests are based on mating and parental drives, on sex with its 'imperious desires and staggering consequences'. On the other hand, a recreational interest is unlikely to be so directly and firmly rooted in essential impulses, and thus to be less provoking of emotion, less urgent, less 'real'. It is important to bear this tendency in mind, for we shall see that it is an important factor in various social reactions.

These interests, then, varying in their importance, are the units which make up personality. But the union is not just a mixture. It is an integration. Just how the union takes place is still a matter for both research in child psychology and for speculation. However, we can be reasonably certain of the following. Differing native constitutions and different environmental influences result in a child's developing differing sets of interests. While this is going on he is building up a sense of his own individuality. At first, probably, this is of his having a body that feels when it is hit, caressed, fed and so on, whereas objects in the environment similarly treated give him no such sensations. Then, with the beginning of conscious direction of behaviour, comes the feeling of being an agent, of having a self. This self it is that experiences cravings or impulses and enjoys satisfactions. As appetites are evolving into interests, the self is beginning to be differentiated from the body and to be characterized more and more as a person who wants this or that, likes one companion and dislikes another, enjoys one kind of activity and abhors another. Conscience, too, is developing so that the actions of the self are capable of yielding remorse or a glow of virtue. An intuitive dualistic philosophy is growing up, none the less important because it is not formulated. The essential core of identity is in the self, the body is a kind of slave—often recalcitrant—that performs actions at the bidding of self, provides the self with pleasurable experiences but may also furnish the self with pain or sorrow. At the animal level the instinct of preservation operates to preserve the body. At the human level it is the self that must be protected and aggrandized.

By the time self-preservation is applied to the maintenance of a mental rather than a bodily structure the peculiar grouping of interests characteristic of the individual has become an integrated unit, a pattern unique among the 2000 million others in the world. There is enough consistency in his behaviour to enable a friend to predict what he would do under various conditions; that is, he recognizes his interests and grades them roughly on some kind of a scale of relative importance. What is more important is that the individual does this for himself; he builds up a picture of himself—his 'ego ideal' as Freud called it—composed not merely of what others can see but also incorporating his ambitions and aspirations, the likes and dislikes that he may hide from outsiders. If he is honest and intelligent this self-estimate may be reasonably accurate, but we all know the conceited and the sufferers from inferiority feeling whose self-portraits are by no means just. We also are familiar with the 'rationalizations' by which attitudes are justified and behaviour excused, reasonings that the subject accepts as valid although no one else may do so. Thus the ego-ideal may be considerably different from the real personality. Its illusory nature might not matter greatly if this were just a little game one played with

one's self. But the trouble is that the ego-ideal becomes, for the subject, the inviolable self. If the illusion is of capacity only a bit greater than critical judgement would allow, no harm, even good may come of it. 'A man's reach must exceed his grasp, else what were Heaven for.' But when reality and ideal are badly out of step, one is engaged with chimaerical schemes the failure of which is apt to be assigned to bad luck or the ill-will of others. Further, memories of past achievements or lapses are apt to be distorted or repressed, so that the subject's idea of what he has been and has experienced may be more myth than history.

It will be clear that any given personality is something that can never be described with complete accuracy. This is for two reasons. First, all that any observer can record is such actual behaviour as it is feasible for him to witness and such confessions as to motive and attitude as the subject may divulge. The former must always be limited in extent, and the latter is coloured by the *rapport* between the subject and the observer. We unbend more with one companion than another, but some thoughts and feelings always remain incommunicable. Somewhat similarly the view any man has of himself is seen through spectacles of hope or fear of self-justification or of self-blame. Secondly, personality is not a fixed structure that travels from birth to death unchanged as a ship will be from the beginning to the end of its voyage. It is more like a river, turbulent in some stretches and picking up silt which it deposits as it meanders through a plain. Environment is constantly changing so as to modify the balance of interests and change the ego-ideal, while the balance is also affected by bodily factors. The years that bring the philosophic mind are those when the fevered blood of youth is no longer coursing through one's veins. Who can say in what year and in what environment a man is his 'real self'?

Yet there is continuity and there is a constant resistance to violent change. This is most decisively proved, not by a certain degree of consistency in behaviour—which we tend to take for granted in our neighbours—but when that which has been integrated disintegrates. Words or actions that are totally unexpected shock the family and friends of one who breaks down mentally. They say 'He is not himself'. This is mental disease. It is the failure of personality to maintain control of impulses, not elements previously absent, but appetites and interests that had been tamed and woven into the total integration so as to form only subsidiary parts of the whole pattern. When personality goes the parts dominate the whole and a new unstable pattern appears.

We see, thus, that the analogies between ethos and personality are strong. Each is a gradual and continuing growth, each is an integration of elements from which a new unit emerges controlling the components, yet neither is capable at any moment of exact description. These are analogies but perhaps the similarities are not there by chance. Each may represent in its own setting a fundamental biological pattern, a general principle of organization. In that case our formulation might read: ethos tends to be to a community what personality is to a man but fails to be so, in so far as the community fails to achieve the complete integration of a true organism.

Some men have personalities that lead to successful adaptation; others fail in that task and, where they do, personality may disintegrate. It seems, too, that some communities develop a successful way of life while others fail for reasons that are moral rather than material. If there are abnormal men and women are there also communities with a pathological ethos? Does the analogy hold to the point of similar symptoms appearing in the group and in the individual?

VI. Summary

1. The evolution and cohesion of social groups is discussed. Following Trotter, it may be argued that group cohesion results from the system of rules, conventions and beliefs unwittingly adopted by the component individuals and which comes to symbolize group membership. It is further argued that the plasticity of human societies may be traced to the fact that the group does not exert a direct and complete control over its members but one that is modified by each member when he transmutes the group's mandate into his personal version of it.

2. The origin and nature of group ideals are examined and examples given of their evolution and vicissitudes in modern society. Shifts in the direction of group ideals from economic to altruistic aims are considered, and the quasi-mystical belief in the immortality of many groups is emphasized. In particular, it is pointed out that the group ideal is never precisely formulated and operates, in part at least, at the unconscious level. Some factors which determine the organization and dominance of groups are briefly discussed.

3. The concept of ethos is introduced with regard to the integration of large communities. It is argued that national ethos is tolerant of slow evolutionary changes but resilient to revolution.

4. The analogy between ethos and personality is developed in some detail. Personality, as an integration of interests, can be directly compared with ethos, regarded as an integration of subgroups and group ideals. Some implications of this view for the pathology of society are briefly considered.

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CONTRAST IN EYE AND BRAIN

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I. *Introduction* (p. 187). II. *The experiments* (pp. 187–191): *Experiment* 1: *Inhibition using a stereoscope* (pp. 187–189); *Experiment* 2: *On the level at which brightness contrast occurs* (p. 189); *Experiment* 3: *To find out whether the 'off' discharge causes a sensation of light or of darkness* (pp. 189–190); *Experiment* 4: *The effect of the illumination of the surround* (p. 190); *Experiment* 5: *Simultaneous contrast* (p. 190); *Experiment* 6: *To find out how the amount of inhibition depends on the brightness, size, and position of the inhibiting field* (p. 190); *Experiment* 7: *To observe whether different portions of the field may be simultaneously inhibited by different amounts* (pp. 190–191); *Experiment* 8: *'On' and 'off' effects with after-images* (p. 191). III. *Discussion* (pp. 192–194). IV. *Summary* (p. 194). *References* (p. 194).

I. Introduction

In attempts to find out at what level simultaneous contrast occurs, most of the work that has been done in the past has been on colour contrast. Many views have been held. Thus Helmholtz ascribed contrast colours to an error of judgement; Hering (1886, 1887, 1888, 1890, 1905) opposed this view. Hartridge (1915) maintained that contrast took place at a cortical but subconscious level. Others, such as Sherrington (1897) and Bidwell (1901), maintain that while contrast for the most part occurs without judgement being concerned, it may sometimes play an important part, as, for instance, in the experiment of Waller (1891). Also when judgement plays a part it may be to correct an illusion rather than to create one (Sherrington, 1897). Binocular experiments using a stereoscope have been described by Hering (1890), Burch (1900), and Hartridge (1915). Schouten & Ornstein (1939) describe binocular experiments in which one eye is affected by a glare source. These binocular experiments prove definitely that there are some contrast phenomena which are not due to errors of judgement. A separate line of research has been that of Granit (1947), who has discovered a wealth of inhibitory effects in the retina itself. An extensive review of the literature on interaction is given by Creed (1931).

In this paper evidence is given that contrast effects occur in the retina, and an attempt has been made to relate these and other effects to the known electrical response of the vertebrate eye.

II. The experiments

Experiment 1. *Inhibition using a stereoscope*

Two small wooden boxes were attached to a stereoscope as shown in Fig. 1(*a*). Each box was divided into two parts by a transverse partition of sheet tin painted white. In each of these partitions a $\frac{1}{4}$ in. hole was punched. These holes were punched at different levels, the hole in the left partition being 1 in. higher than that in the right. Thus when the two images are combined, the two holes do not coincide. The compartment behind each partition was dimly lit by a lamp controlled by a resistance. Each partition could be brightly illuminated from in front by a motor-car headlamp bulb controlled by a switch. With the headlamp bulbs switched off the binocular picture is of two patches of light one above the other on a dark ground.

When one headlamp, say the left, is switched on, a dramatic result is obtained (see Fig. 1(*b*), (*c*)). The light in the upper hole seen by the left eye appears instantaneously

extinguished, while the lower one seen by the right eye remains bright, and both are seen against a bright white ground. The patch which remains visible, in this case the right patch, stands out as apparently brighter than the bright surround against which it appears, though it is actually about one hundred times less bright. If the illumination of

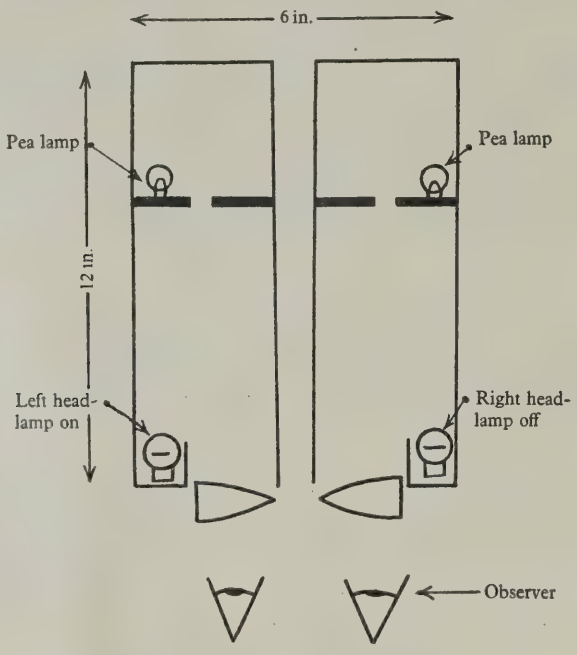

Fig. 1 (*a*).

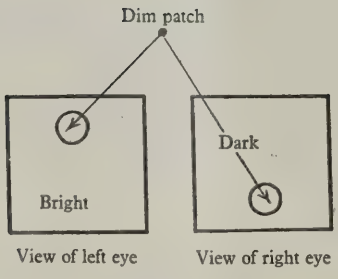

Fig. 1 (*b*).

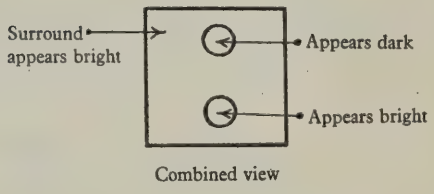

Fig. 1 (*c*).

Fig. 1. (*a*) Shows arrangement of the stereoscope used in Exp. 1. The boxes are painted white inside, and so are the transverse partitions. (*b*) Shows the view of the left and right eyes. The labelling refers to the actual physical intensities. If the right eye only is used a dim patch is seen on a black ground. If the left eye only is used a *black* patch is seen on a bright ground. (*c*) Shows the combined view of the two eyes. The difference in the appearance of the two patches is very striking.

the right patch is reduced, a point is finally reached when it is no longer visible. In this case a single dark patch (the patch seen by the left eye) appears alone against a bright ground. However dim the right-hand patch may be, as long as it is visible it always appears to be brighter than the background.

The experiment shows that brightness contrast can occur separately in the nervous

pathways of the left and right eye, and that it can occur without any process of judgement taking place. It does not show at what level contrast occurs.

Experiment 2. *On the level at which brightness contrast occurs*

A vertical rectangular strip of light, 3 in. wide and 8 in. long, is projected by the lantern on to the centre of the white front of a large box. A rectangular piece 1 in. wide and 4 in. long is cut out of the front face of the box on either side of the bright strip. The box, painted white inside, is dimly lit from within. Thus the observer sees a wide vertical strip of brilliant white flanked on either side at its middle portion by two much dimmer strips.

The observer, seated about 8 ft. from the box, using his right eye, fixates the right-hand edge of the bright centre strip. On account of the partial decussation of fibres at the chiasma it happens that the impression of the bright strip and of the left dim strip are received both together in the right cortex; the right dim strip is recorded by itself in the left cortex. Both dim strips appear, however, of the same apparent brightness.

To confirm this result the following variant is performed. The right eye fixates alternately the right edge and the left edge of the right dim strip. So it happens that the centre bright strip is recorded always in the right cortex, whereas the right dim strip moves now to the right and now to the left cortex. No change in brightness can be noticed.

As a control, the bright strip from the lantern is now moved so that it lies to the right of the right dim strip. The right strip now appears much dimmer than the left strip.

Experiment 3. *To find out whether the 'off' discharge causes a sensation of light or of darkness*

A sector disk half black, half clear, was revolved at two revolutions per second in front of a lamp and lens (Fig. 2), and placed inside a large box painted white inside. Thus the

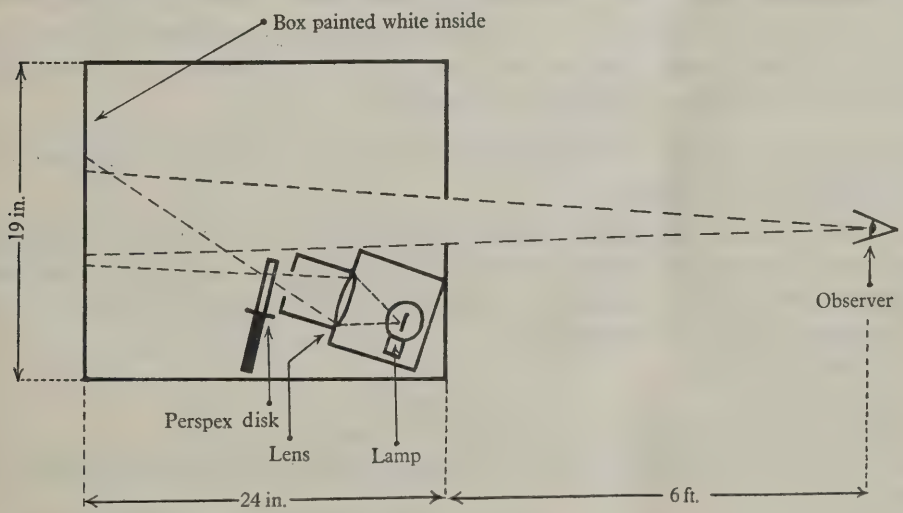

Fig. 2. Shows the apparatus used to demonstrate the persistence of vision and its inhibition by illumination of the surround (Exps. 3 and 4). The front of the box may be illuminated by a projector lantern (not drawn).

inside of the box was alternately illuminated and darkened for successive periods of $\frac{1}{4}$ sec. The observer, in darkness, looked at a hole 2 in. in diameter cut in the centre of the front face. Eleven observers were asked to estimate the apparent on-off ratio. Some

replied by giving a figure for the estimated ratio. Others said it was on for longer than it was off, but gave no figure. These observers were then asked if the ratio was greater or less than 100:1. They agreed that it was less than this. Likewise they agreed that it was greater than 1·01:1. After questioning like this they then agreed to give an estimate of the ratio, stressing that it was only approximate. The estimate varied from 1·5:1 to 5:1, the mean value being 3:1. The only value of these estimated ratios is the relation between them and the estimated ratios of Exp. 4.

Experiment 4. *The effect of the illumination of the surround*

The front face surrounding the hole was painted white and brightly illuminated by a beam from a projector lantern (20 ft.-candles). The apparent on-off ratio was now approximately 1:1. For the same eleven observers the estimations of the ratio varied from 1:2 to 2:1, the mean value being 1·2:1.

Experiment 5. *Simultaneous contrast*

The box was dimly lit from within by a steady illumination. The hole viewed from in front appeared as a patch of light which was quite easily visible. On the white surround being illuminated by the beam from the lantern, the light in the hole immediately appeared to be extinguished. This is the well-known effect of simultaneous contrast. The experiment has been described by Hering (1905) and Hess (1920). It is included at this stage to show that the same experimental arrangement which produces inhibition of the persistence of vision also produces simultaneous contrast.

Exps. 3, 4 and 5 were carried out by subjects who were adapted to normal artificial room lighting. The effects are not greatly dependent upon the state of adaptation of the eye. The evidence from these experiments suggests that a sensation of light persists for about $\frac{1}{10}$ sec. after the light has been switched off, that this persistence of vision may be inhibited by illumination of the surround, and that the mechanism which does this is the same as that which causes simultaneous contrast.

Experiment 6. *To find out how the amount of inhibition depends on the brightness, size and position of the inhibiting field*

The same apparatus was used. The box was dimly lit from within by steady illumination. A bright circular patch was thrown on to the white painted front of the box from a projector lantern. By varying the position, size and brightness of the patch it was easy to show that the inhibitory effect was increased by

(1) The brightness.
(2) The size.
(3) The nearness of the bright patch to the dim patch.

These effects could be seen clearly at a glance without making any numerical measurements.

Experiment 7. *To observe whether different portions of the field may be simultaneously inhibited by different amounts*

The front of the box was now closed by a sheet of white paper from which a horizontal slot 1 in. wide had been cut, as shown in Fig. 3. The box was dimly lit from within. A bright patch from the lantern was projected so that it lay by one end of the slot, as

shown in the figure. When the observer looks at the front of the box, the left-hand end of the strip which is nearest to the bright patch appears black, while the right or remote end appears quite easily visible, there being a gradual transition from one end to the other. Thus the inhibitory influence diminishes with the distance away from the bright patch. This confirms the observations of Schouten & Ornstein (1939), who reached the same conclusions by a less direct method.

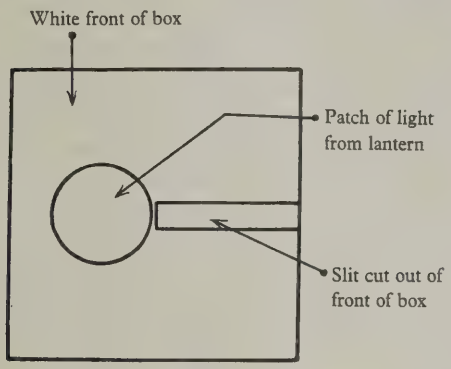

Fig. 3.

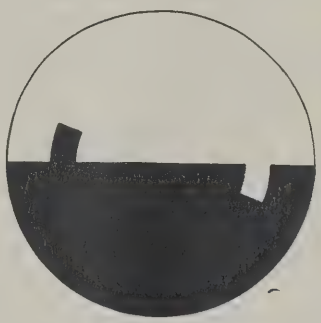

Fig. 4.

Fig. 3. Front view of the box used to show that different portions of the field may be simultaneously inhibited by different amounts (Exp. 7). The slit appears dark on the left and light on the right.

Fig. 4. Reproduced from *J. Physiol.* xxi, 33 (1897), by kind permission of the Editor and Sir Charles Sherrington. When rotated clockwise the ring band corresponding to the tooth and notch has a higher critical flicker frequency than the rest of the disk. For an anti-clockwise rotation the critical frequency of flicker is approximately the same for all parts of the disk.

Experiment 8. *'On' and 'off' effects with after-images*

The observer looks at the filament of an electric-light bulb for a few seconds, and then directs his gaze to a dark portion of the room. A practised observer will perceive the after-image of the filament of the lamp. This will gradually fade. However, it may be revived by the following method. A bright light is shone on the observer's hand. He waves his hand up and down, and at the same time looks through his waving hand to the dark portion of the room. Instantly the faded after-image is vividly revived.

During the preliminary exposure period the left eye may be closed while the right eye looks at, say, a single lamp; then the right eye is closed while the left eye looks at, say, a pair of lamps. Now if, while the left eye is closed, the right eye looks through the waving hand, the after-image of the single lamp will appear; if, while the right eye is closed, the left eye looks through the hand, then the after-image of the pair of lamps will appear.

An alternative to looking through the waving hand is to view the slowly flickering bright centre patch of the box used in the previous experiments. After-images are very clearly seen in the patch. This suggests that the essential factor in the waving hand experiment is the intermittent illumination that it produces on the area of retina concerned. Other experiments along these lines have been described by McDougall (1901).

III. Discussion

There are two separate aspects of the stereoscope experiment (Exp. 1) to be discussed. The first is that the dim patch seen by the right eye, which is not inhibited, stands out as apparently brighter than the bright surround against which it appears, although it is actually about 100 times less bright. A clue which is some guide to the explanation is afforded by the colour of the dim patch. Owing to the difference between the pea lamps and the head lamps, it happens that the dim patch has a slightly yellow hue, whereas the surround gives the impression of being white. Now when the patch is combined stereoscopically so as to appear on a white ground, the colour is still seen to be the same yellow as that which appears when it is seen by the right eye alone against a dark ground. This shows that the sensation of the bright patch which stands out as brighter than the bright surround is due to impulses from the right retina. Were the sensation to be due to an addition of the impulses from the two retinae, the colour of the yellow would be greatly weakened (desaturated) by admixture with white. Impulses from the corresponding left retinal area must be inhibited before they reach consciousness. This, then, makes it all the more remarkable that the dim patch does in fact stand out as apparently brighter than the bright ground. It is as though the right eye perceived a degree of contrast between the dim patch and the black surround, and that in the combined impression this degree of contrast is maintained when the surround appears bright. It is difficult to make a satisfactory definition of contrast which would enable a quantitative experimental investigation to be carried out, so the suggestion that the degree of contrast is maintained can only remain a vague idea.

The other aspect of this experiment to be discussed is that the one patch is inhibited while the other patch is not. This shows that brightness contrast can occur separately in the visual pathways of the left and right eye, and so brings brightness contrast into line with colour contrast. The experiment does not show at what level the contrast or inhibition occurs.

However, Exp. 2 shows that the degree of dimming of a patch caused by the presence of a bright patch is not affected by whether the bright and dim patch are recorded together in the same side of the brain or in opposite sides. This suggests very strongly that the contrast does not occur at either the external geniculate body level or cortical level. The fact that the degree of dimming depends greatly on the relative position on the retina of the bright and the dim patches suggests very strongly that brightness contrast occurs in the retina. The great number of horizontal and amacrine cells makes this seem likely.

It must be stressed that though it has been shown quite definitely that there are contrast effects in which consciousness and judgement play no part, this rules out neither the possibility that errors of judgement may cause contrast effects, nor the possibility that judgement may modify contrast effects elaborated at a subconscious level.

Having now good grounds for believing in the reaction of one part of the retina on another, we may consider Experiments 3–7. Broca and Sulzer (1902) have shown that when a light is first switched on the apparent brightness is considerably greater than it is when the steady state has been reached. Adrian (1928) pointed out that this initial extra brightness probably corresponded to the electrical 'on' effect. Experiment 3 shows that the sensation of light persists for approximately one eighth of a second after the light has been extinguished and this time is of the same order as the retinal 'off' discharge in the

cat. Experiment 4 shows that the persistence of vision is greatly reduced or abolished by illumination of the surround. Now for quite other reasons Granit and Tansley (1948) have suggested that the electrical 'off' effect is inhibited by illumination of the parts of the retina surrounding the off elements, the inhibition being mediated by the amacrine cells. Thus we have two reasons for supposing that the electrical 'off' effect corresponds to a sensation of light; firstly because they last for a time which is of the same order, and secondly because they both appear to be inhibited by the illumination of the surrounding retina.

Against this we must set the fact that in the human electro-retinogram there is little or no 'off' effect. This does not prove that there is no optic nerve discharge at 'off', as the relation between the optic nerve discharge and the electro-retinogram is not clearly established, but it does nevertheless constitute evidence against the view which is being presented here.

The idea of the inhibition of the 'off' effect may be usefully applied to explain why the flicker phenomena shown by certain disks depend on the direction of rotation. These disks were described by Sherrington (1897). Consider the disk shown in Fig. 4. 'When whirled in the direction of a clock hand, the ring band corresponding with the tooth and notch flickers at higher speeds than does the disk elsewhere. Whirled in the reverse direction the flicker in the ring band is not greater or hardly greater than in the disk elsewhere.'

Consider the small retinal area stimulated in turn by successive portions of the ring band corresponding with tooth and notch, while the disk revolves clockwise. When this retinal area becomes covered by the image of the black tooth, that is, at the 'off' period, the portions of the retina immediately surrounding this area receive a white image and will be inhibiting the 'off' effect; thus persistence of vision is reduced and the critical flicker frequency is increased. Portions of the retina corresponding to areas of the disk outside or inside the ring band made by the tooth and notch do not receive this inhibition, for when they receive the black image so also do the areas of retina immediately surrounding them. Thus without inhibition there is more persistence, and so the critical frequency of flicker is lower. It is possible that this effect is also reinforced by a corresponding absence of inhibition of the 'on' effect for the white tooth.

When the disk is whirled in the reverse direction, then when the area of retina we are considering becomes covered with the image of the black portion of the disk, so also does the surrounding retina. Hence there is no inhibition of the 'off' effect, and so for a counter-clockwise rotation the critical frequency of flicker is lower. The same explanation may be applied to the other disks which show this effect. The well-known experiment of the black and blue rings on the black and yellow ground, described in the same paper, is also readily explained in a similar way.

Lythgoe & Tansley (1929) investigated the effect of the illumination of the surround on the critical frequency of flicker of a small patch. They found that starting with the surround in darkness, as the illumination of it was increased, so also was the critical frequency of flicker. This is readily explained in terms of inhibition of the 'off' effect. When, however, the surround was made brighter than the patch, the critical flicker frequency again decreased; this shows that other factors are operating. Probably one such factor is inhibition of the 'on' effect.

Exp. 5 on simultaneous contrast shows that the same experimental conditions which cause reduced persistence of vision also cause simultaneous contrast. The simplest ex-

planation seems to be that if a small area of retina is surrounded by a brightly illuminated portion, then all activity in the small area is reduced by inhibition, whether this activity be 'on', 'off', or steady discharge effect.

Concerning Exp. 8, it is sometimes assumed that because after-images follow every movement of the eyes with the utmost precision, it follows that after-images are due to retinal activity. This is not a valid deduction. The fact that after-images follow every movement of the eye means only that the position of the after-image in the visual field remains fixed. This will be so at whatever 'physiological' level there occurs the activity which is responsible for the after-image. Exp. 8 shows that after-images may be formed separately in the two visual pathways, but it does not show at what level they are formed.

IV. Summary

By means of a stereoscope it is shown that brightness contrast occurs separately in the visual pathways of the left and right eyes. Evidence is given that this contrast effect occurs in the retina, and that those same inhibitory retinal processes which are responsible for simultaneous brightness contrast also cause the following phenomena:

(*a*) The reduction in the persistence of vision caused by the illumination of the surround.

(*b*) The inhibition of the 'off' discharge of the optic nerve fibres caused by reillumination of the retina.

(*c*) The dependence of the critical frequency of flicker of certain disks on the direction in which they are rotated.

(*d*) The dependence on the arrangement of the background of the critical frequency of flicker of black-blue rings.

(*e*) The reduction in the critical frequency of flicker which occurs when the brightness of the surround is increased from zero up to a brightness equal to that of the flickering patch.

'On' and 'off' effects may be used to revive faded after-images.

After-images may occur separately in the two visual pathways.

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TWO EXPERIMENTS ON FATIGUE AS AFFECTING SKILLED PERFORMANCE IN CIVILIAN AIR CREW

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A. *Introduction* (p. 195). B. *Experiment I: Electrical Problem* (pp. 196–201). C. *Experiment II: Grid-Matching* (pp. 201–209). D. *Concluding Note* (pp. 209–211). E. *Summary* (p. 211). *References* (p. 211).

A. Introduction

The two experiments described here were carried out at the B.O.A.C. Flying Boat Base at Southampton, in an attempt to secure objective measures of changes in the performance of air crew as a result of flying fatigue. For this purpose we have taken measures of performance by crew members, both before and after flights, at realistic complex tasks, and have tried to analyse these into components which would indicate the nature of the changes taking place. We have chosen this method because, compared with any simpler, more 'elemental' measures which might be taken,

(*a*) it would appear that if changes of performance occur with flying fatigue, they are more likely to be shown by tasks at least as complex as those with which the crew concerned normally deal, than by tasks which are considerably simpler, and

(*b*) the complexity of the compensatory mechanisms of human behaviour is such that even if significant effects could be shown on very simple sensory and motor functions studied in relative isolation, the effects of these changes when acting in a larger whole are not, in the present state of knowledge, predictable with any certainty.

For the present study we have taken two classes of crew member, namely, Radio Officers as having duties which involve mainly mental work, and Stewards as having duties which involve physical work. The former were used in both the experiments described here, the latter in the second only.

The method of the experiments has been to take two groups of subjects and to conduct the testing of them in two stages as follows:

FIRST STAGE. Group A. The aircrew concerned came to us as soon as they had cleared Customs after returning from a flight, i.e. within about half an hour of landing.

Group B. Aircrew out-going on flights came to us the day before they were due to depart, i.e. about 18 hours before departure.

SECOND STAGE. Group A. The aircrew previously tested on return from a flight were retested after a stand-down of at least 8 days.

Group B. The air crew previously tested out-going were retested as soon as they returned, i.e. between 6 and 21 days later.

In obtaining air crew no special selection was made, but all those on the schedule were taken until the numbers required by the experimental designs were filled up.

B. Experiment I. Electrical problem experiment

The apparatus for this consisted of a number of small boxes each with a row of terminals on top. These terminals were connected underneath by resistances of 300 ohms. The subject was given a box together with a resistance meter and a circuit diagram which showed the connexions between the terminals in the box but did not indicate which of the terminals shown in the diagram corresponded to each of the terminals on the box. The subject's task was to deduce which terminals corresponded to which by means of readings taken on the resistance meter.

This task was chosen for the present investigation as being likely to be understood by Radio Officers, and to be capable of engaging their interest as a meaningful and in no sense trivial exercise.* The nature of the task was such that the physical effort involved was negligible, and the essential requirement for obtaining a solution was the use of data which, when correctly interpreted, led to a logically consistent conclusion which could be checked for accuracy.

Six different boxes were used, four with six terminals, two with ten. At each stage of the experiment, three boxes were given: first, two with six terminals, then one with ten. The order of presentation of the various boxes was such that within this scheme each subject was given all the boxes either in the first or second stage,† and that each box appeared an equal number of times in each position in the order.

Results

The averages for the different groups as regards the three measures taken in the experiment, i.e. *number of terminals correctly identified*, *time taken* and *number of meter readings taken*, are shown graphically in Figs. 1–3. In working out the means for time and readings, we have used geometric means, as these appear best to represent the central tendencies of the groups concerned. As a check, however, arithmetic means were also worked out and were found to present essentially the same picture in spite of their liability to be unduly influenced by single subjects who take very long times or very large numbers of readings. As a further check, a number of significance tests were made by the ranking methods developed by Kendall and extended by Whitfield (Kendall, 1948; Whitfield, 1947).

Differences between those tested first when fresh and those tested first when tired. Taking the means of the two groups considered as wholes (indicated by the solid lines on the graphs), two points seem clearly to emerge:

(1) While *accuracy* increases from about 70 to 90% as between the first and sixth box, the two groups are closely similar at all stages.

(2) As regards *times* and *readings*, the group tested first when tired shows a poorer performance than the group tested first when fresh, during *both the first and the second stages of the experiment.*

The group tested first when tired is especially poorer at solving the first box presented, the increase of both time and readings as between this group and the group tested first

* Both these expectations were fulfilled except in the case of one subject whose results have in consequence been excluded.

† With the exception of four subjects tested at the beginning of the experiment who did not do the ten-terminal boxes.

when fresh being of the order of 100%. Both this rise and the general rise for all the boxes taken together are significant for both times and readings.

These rises in the case of the boxes presented during the first stage of the experiment are to be expected if fatigue resulting from the trip affects performance at this task, but it is not so readily understandable why those tested first when tired should show a poorer performance when fresh than those tested first when fresh show when they are tired. The first hypothesis to account for these results would be that by some mischance we had

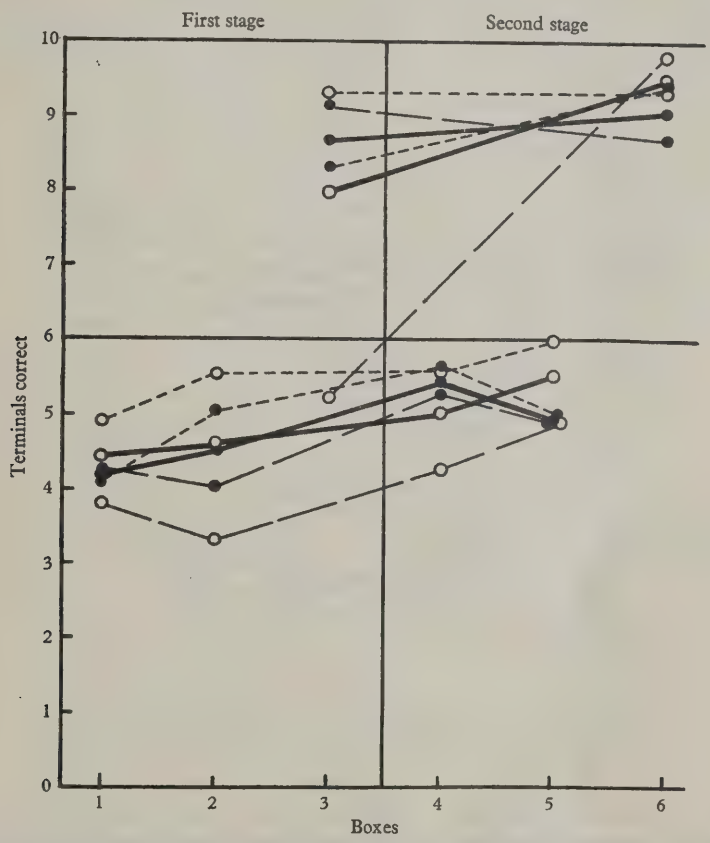

Fig. 1. Electrical problem experiment. Mean numbers of terminals correctly identified. Open circles = subjects tired in the first stage of the experiment and fresh in the second. Filled circles = subjects fresh in the first stage and tired in the second. Solid lines = 'easy' and 'hard' trips together. Short-dashed lines = 'easy' trips. Long-dashed lines = 'hard' trips.

obtained two groups of unequal ability. It seems clear, however, that this apparently simple explanation must be rejected in view of the following considerations:

(1) The method of selection of subjects was a purely random one, since it was entirely on the basis of which air crew happened to be on duty during the period in which the experiments were being conducted.

(2) Although an experiment with this apparatus had shown differences of performance associated with age, the mean ages of the two groups concerned were almost exactly the same (see Table 1).

(3) The subjects in each group were divided into two subgroups, one containing those returned from or going out on what were regarded as hard trips, the other containing subjects returned from or going out on what were regarded as easy trips. The classification of trips was based on the long-standing reputations of various routes among the air crew generally (not only those we tested). Complaints made about the routes on which trips were regarded as 'hard' were many and varied, but *objectively* the outstanding difference between 'hard' and 'easy' trips was that on the latter the proportion of time spent resting

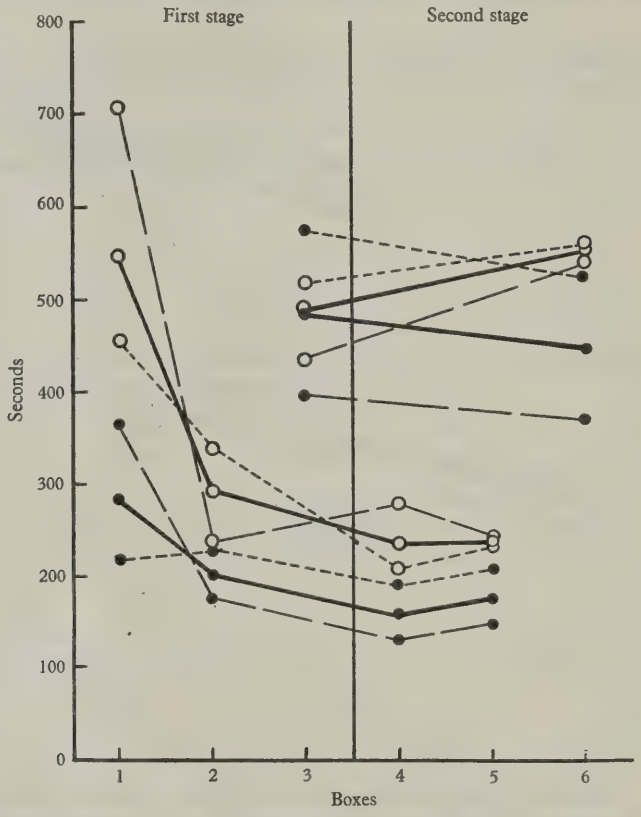

Fig. 2. Electrical problem experiment. Mean times taken to solve boxes. Open circles = subjects tired in the first stage of the experiment and fresh in the second. Filled circles = subjects fresh in the first stage and tired in the second. Solid lines = 'easy' and 'hard' trips together. Short-dashed lines = 'easy' trips. Long-dashed lines = 'hard' trips.

between 'hops' was very much higher than on the former. These subgroups are indicated by the long-dashed and the short-dashed lines respectively in Figs. 1–3. The numbers and mean ages of those concerned are set out in Table 1. Further consideration must be given to these subgroups later, but in the present connexion it is to be noted that the separation between those tested first when tired and those tested first when fresh, which was noted for the groups as a whole, are in general maintained by the subgroups. Indeed, for the six-terminal boxes, the separation is perfect.

(4) In anticipation of what is to be said of the results of the second experiment, it may be mentioned that the same phenomenon was noted in the results of both the present Radio Officers and the Stewards tested in that experiment.

The finding of this phenomenon in four independent groups and in two independent experiments seems to indicate clearly that it cannot be due to any sampling mischance, and must be supposed to be due to some effect of the condition of the subjects. It would appear that subjects who met these problems for the first time when they were tired

Table 1. *Subjects taking part in electrical problem experiment*

	Tested first when fresh		Tested first when tired	
	No.	Mean age	No.	Mean age
Easy trips	6	33·2	7	30·4
Hard trips	6	29·7	5	32·2
Total	12	31·4	12	31·2

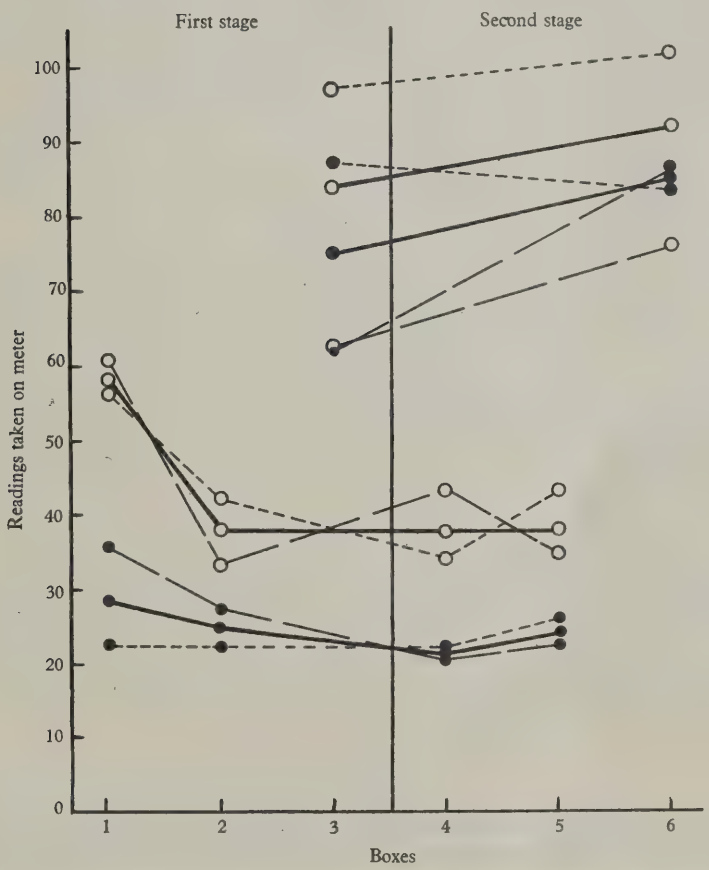

Fig. 3. Electrical problem experiment. Mean numbers of meter readings taken. Open circles = subjects tired in the first stage of the experiment and fresh in the second. Filled circles = subjects fresh in the first stage and tired in the second. Solid lines = 'easy' and 'hard' trips together. Short-dashed lines = 'easy' trips. Long-dashed lines = 'hard' trips.

gave a relatively poor performance in the sense that they took longer and required more meter readings, and that this poorness of performance carried over to the situation in which they met the problems for a second time after a rest. In contrast, those subjects who met the problems for the first time when they were fresh showed a relatively good performance which was maintained even when they were tired.

Differences between 'hard' and 'easy' trips. More striking in some ways than the difference between our two *groups* are differences between the *subgroups* within each of these groups, of subjects coming in from or going out on 'hard' trips as opposed to those coming in from or going out on 'easy' trips. As previously mentioned, the results from 'hard-trip' subjects are indicated by long-dashed lines and those from 'easy-trip' subjects by short-dashed lines on Figs. 1–3.

Three points about these results seem especially worthy of mention:

(1) The 'hard-trip' and 'easy-trip' subjects appear to show rather characteristic patterns as regards time taken. During the first stage it will be seen that of those tested first when they had just returned from a flight, the 'hard-trip' subjects take considerably longer over the first box and less time over the second and third boxes than do the 'easy-trip' subjects. This pattern of times seems to be repeated in a minor way both by this group in the second stage of the experiment and in the first stage by the group tested first before they went out. This rather surprising fact raises the important question of whether the effects of going out on 'hard' trips are entirely the *result* of the trips themselves, or whether there are also some chronic or anticipatory effects as well. As the Radio Officers concerned did not keep regularly to any one particular trip, anticipatory effects would seem to provide a more likely explanation than chronic.

(2) 'Hard-trip' subjects tested first when tired took slightly more readings over the first box than did 'easy-trip' subjects, but took fewer over the second and third (see Fig. 3). As in the case of the times taken, this pattern of results was repeated by these subjects in the second stage of the experiment and in the first stage by those tested first when fresh.

(3) The subjects meeting the tasks for the first time when incoming from 'hard' trips were strikingly and significantly less accurate than those meeting them first when coming in from 'easy' trips. Indeed, if the number of terminals correctly identified in all three boxes of the first stage are added together, the best subject coming in from a 'hard' trip was less accurate than the worst of those coming in from an 'easy' trip—who were surprisingly the *most* accurate of all the subgroups. It is, perhaps, also worth noting in this connexion that the only subject who broke down completely and was unable to finish the task was one who had just returned from a 'hard' trip. For obvious reasons his results have not been included for purposes of quantitative treatment. In contrast, the 'hard-' and 'easy-trip' subjects who had learnt the task when fresh showed no great difference of accuracy when they were subsequently tested when tired.

Discussion

From the results of this experiment it would seem that the following tentative conclusions can be drawn, although further work is necessary before they can in any sense be claimed as established.

(1) Subjects presented with the tasks for the first time when they were tired, *took longer* and required *more data* (meter readings) to produce solutions of the problems.

(2) Of these subjects, those who had returned from 'hard' trips showed, as compared with those who had returned from 'easy' trips, markedly poorer accuracy.

(3) Those who had met the tasks for the first time when they were fresh did not show such disabilities to any marked extent on being retested when tired.

If these results can be regarded as in any way typical, their implications would seem to be that so long as no unusual demands are made upon subjects when they are tired,

their performance is likely to show little, if any, loss of efficiency. In the face of any novel requirements, however, tiredness will result at least in a lengthening of the time and an increase in the data required for dealing with them, and in the case of those returning from 'hard' trips seems likely to result in a serious loss of accuracy.

C. Experiment II. Grid-matching experiment

In this experiment the subject was confronted by an apparatus on which was a plate carrying two pieces of graph paper approximately 6×4 in. The subject's task was to move, by means of a handle, a pointer with a spot on it so as to make the position of this spot on the right-hand piece of graph paper similar to that of a small steel ball about $\frac{1}{16}$ in. in diameter on the left-hand piece, relative to vertical and horizontal co-ordinates on the two pieces. The lay-out of the grids and pointer is shown diagrammatically in Fig. 4.

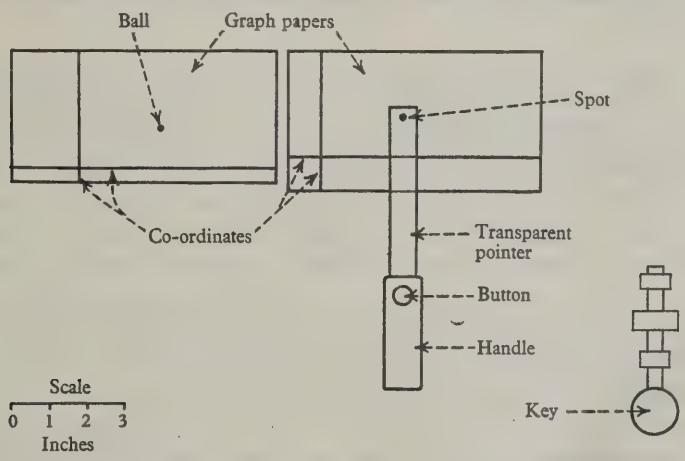

Fig. 4. Grid-matching apparatus. Diagram of display and controls.

When the subject thought the pointer was in the correct position he pushed a small button mounted on the handle. If his judgement was correct, the ball started to move about the left-hand grid; if it was incorrect, nothing happened.

The subject went on making attempts until he was successful in making the ball move. He was instructed that as soon as this occurred he was to press a key at the side of the apparatus which stopped the ball in a new position on the left-hand grid, and was then to start the cycle of operations over again.

It will be seen that the subject was set a fairly complex skilled task. The nature of this task was such that the subject had to make the same achievement each cycle of operations, i.e. causing the ball to move and stopping it again. The pattern of hand movements required was, however, different for each cycle, so that the task did not involve the building up of any strictly stereotyped succession of movements. But it was sequential in the sense that the completion of each portion set the stage for the performance of the next.

The design of the experiment again involved the comparison of tired with fresh subjects, and was conducted in two stages in a manner similar to that of the first experiment. Each subject was given a short practice period and then half an hour's continuous work on the apparatus in each of the two stages. The task was again one in which the total

performance could be split up and measures taken of different aspects of the performance. Several of these measures had previously shown significant differences with age and also with loss of sleep. The task was selected for the present study because it measures considerably more accurate *motor performance* than does the electrical problem experiment and thus broadens the scope of the investigation.

The subjects who took part in the experiment fall into two sets:

(1) *Radio Officers.* With three exceptions all those who took part in the first experiment took part in this one also. In addition, two Radio Officers whose results had to be excluded from those of the first experiment are included here.

(2) *Stewards.* One Steward from each of the aircraft in which the Radio Officers flew was also tested. Unfortunately, three of these Stewards failed to complete the second stage of the experiment, and so their results on the first stage had to be excluded.

The numbers and mean ages of the subjects completing both stages of the experiment are given in Table 2.

Table 2. *Subjects taking part in grid-matching experiment*

	Tested first when fresh				Tested first when tired			
	Easy trip		Hard trip		Easy trip		Hard trip	
	No.	Av. age	No.	Av. age	No.	Av. age	No.	Av. age
Radio Officers	5	37·0	7	30·0	7	30·6	4	32·3
Stewards	4	30·3	4	28·0	5	34·2	4	24·5

The measures taken in this experiment form a double analysis of the performance with respect to *events recorded* and *times taken* over different portions of the task.

A. *Events recorded.* These may be divided into:

(1) The number of 'runs' made during the half-hour allowed, i.e. the number of cycles of operations from stopping the ball in one position on the grid to stopping it again in a new position after having made it move. For each run two events are recorded, namely, a successful attempt to start the ball, and a pressing of the key at the side of the apparatus to stop it again.

The total number of runs may be subdivided in respect of accuracy, e.g. into those in which errors were made before success was achieved as opposed to 'direct hits.' A convenient measure of accuracy for certain purposes is the *percentage of 'direct hits'*.

(2) Unsuccessful attempts or 'errors'. These fall into two classes:

(*a*) Small—the more usual type, when the pointer is less than half an inch from the correct position. These are usually due to minor errors of placing the pointer.

(*b*) Large—not made by all the subjects. These occur when the position of the pointer is wrong by about an inch, i.e. by a whole large square on the graph paper, and indicate gross errors of plotting.

B. *Times taken. The average time per run,* which is, of course, essentially the same measure as the number of runs made in the half hour, may be divided into:

(1) 'Time to first attempt', i.e. the time from stopping the ball at the end of one run to making the first attempt, whether successful or unsuccessful, to restart it. This measure covers the time taken by the plotting task proper, i.e. the initial matching of the position of the pointer to the new position of the ball.

(2) Time taken to stop the ball once it has started to move.

(3) Times spent making errors, both small and large. These times may be further analysed into *times per error* both small and large.

Although the results of this experiment have been worked out with respect to all these measures, only those that are most important for the present findings will be discussed. In presenting the main results, the half-hour for which the subjects performed during each of the two stages of the experiment has been divided into three 10 min. periods in order that the course of the performance can be studied in greater detail.

Results

It should be remarked at the outset that the performances of both the Radio Officers and the Stewards were of a very high standard compared with those of subjects we had tested previously with this apparatus. This is perhaps to be expected with such a highly selected group, although the possibility of some effect of occupation on performance must be borne in mind.

(A) *Radio Officers*

Radio Officers tested first when they came in from an 'easy' trip showed a performance which was in no way strikingly different from that of Radio Officers tested when fresh. Indeed, the slight differences that do exist are in the direction of a *better* performance, e.g. they made more runs during the half-hour, took a shorter 'time to first attempt' and showed a higher total activity (see Figs. 5, 6). The evidence suggests a slight over-activity which tends to improve performance, but as the differences are not significant no stress can be laid on this finding.

Radio Officers tested first after a 'hard' trip showed performances which were very different from all the other subgroups in certain important respects. Comparing these subjects with those who were tested first when fresh, it seems clear that their performance was strikingly impaired. Thus:

(1) The results given in Fig. 5 show that the total number of events and the number of successes were each some 40% lower in both stages of the experiment. The differences in both these measures were statistically significant. The striking extent of the divergence of these Radio Officers from others is further evidenced by the fact that the fastest of them made fewer successes than the slowest of those tested first after an 'easy' trip.

(2) They took about 85% longer 'time to first attempt' in both stages of the experiment (see Fig. 6), the differences again being significant in each stage. Their average time to first attempt was, indeed, longer than the average time taken by the other groups to complete the whole cycle of operations.

(3) They took some 40% longer to stop the ball after they had started it in both stages of the experiment (see Table 3), although the differences are not significant.

(4) During the first stage they took about 100% longer making small errors, although again the difference is not significant (see Fig. 6).

This longer time spent on errors does not, however, indicate that the subgroup in question was less accurate than the rest. As will be seen from Table 4, they take about 100% longer *time per error* than do the others. This, coupled with the fact that their number of errors (see Table 5) was about 50% less, and percentage of 'direct hits' (see Table 6) was a little more than for those tested first when fresh, makes it clear that the performance of these Radio Officers tested first on return from 'hard' trips was no less *accurate* than that of the others, but *very much slower*. This slowing appears to affect all

aspects of the performance, leading both to a reduction in the total number of events recorded and to longer times over every portion of the cycle of operations.

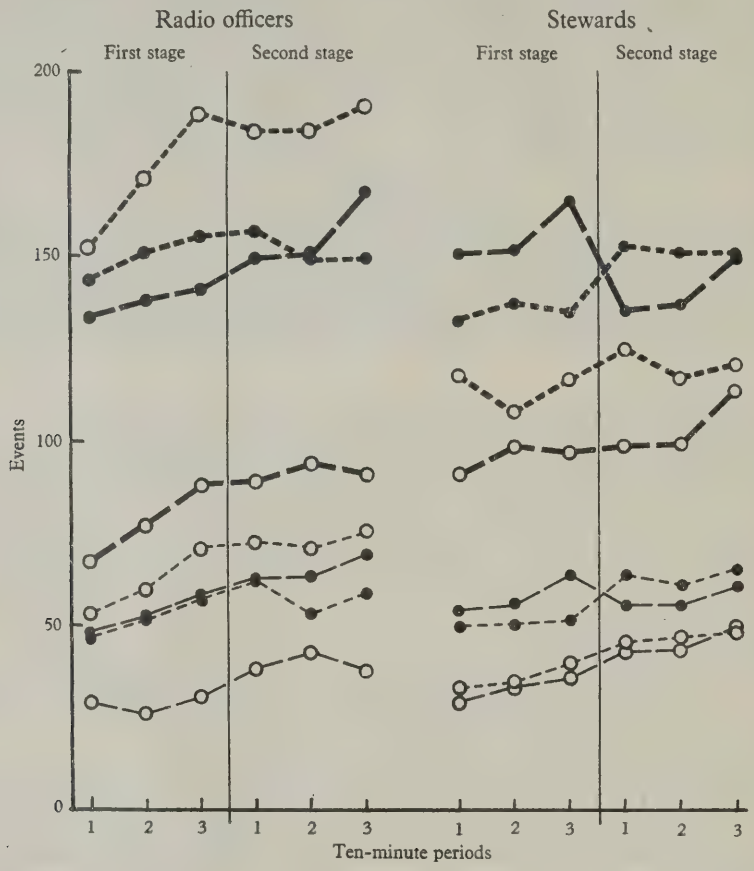

Fig. 5. Grid-matching experiment. Mean numbers of events recorded (per subject). Open circles = subjects tired in the first stage of the experiment and fresh in the second. Filled circles = subjects fresh in the first stage and tired in the second. Short-dashed lines = 'easy' trips. Long-dashed lines = 'hard' trips. Thick lines = total events recorded. Fine lines = 'successes' = number of runs made.

Table 3. *Times from success to stop in seconds per run*

	Radio Officers				Stewards			
	First fresh		First tired		First fresh		First tired	
	Easy	Hard	Easy	Hard	Easy	Hard	Easy	Hard
1st stage	1·10	1·22	0·93	1·68	1·42	1·19	1·15	1·66
2nd stage	1·09	1·07	1·01	1·45	1·19	1·44	1·31	1·26

As in the first experiment, we see in these results the phenomenon that subjects' performances during the second stage of the experiment appear to be a function of their results in the first stage. The slowness during the first stage of the subjects tested first after a 'hard' trip was in nearly every respect reproduced in the second when they were retested after stand-down, while subjects tested first when fresh showed no impairment of performance on subsequently being tested when tired.

Table 4. *Times per small error in seconds per run*

	Radio Officers				Stewards			
	First fresh		First tired		First fresh		First tired	
	Easy	Hard	Easy	Hard	Easy	Hard	Easy	Hard
1st stage	3·19	3·60	2·88	7·71	4·04	4·42	3·96	4·90
2nd stage	2·93	3·87	2·76	6·84	3·78	4·71	3·50	5·19

Table 5. *Number of small errors per subject*

	Radio Officers				Stewards			
	First fresh		First tired		First fresh		First tired	
	Easy	Hard	Easy	Hard	Easy	Hard	Easy	Hard
1st stage	43·3	29·2	43·6	20·0	29·8	36·1	36·1	21·0
2nd stage	35·7	22·2	37·6	11·8	22·9	20·9	23·9	11·4

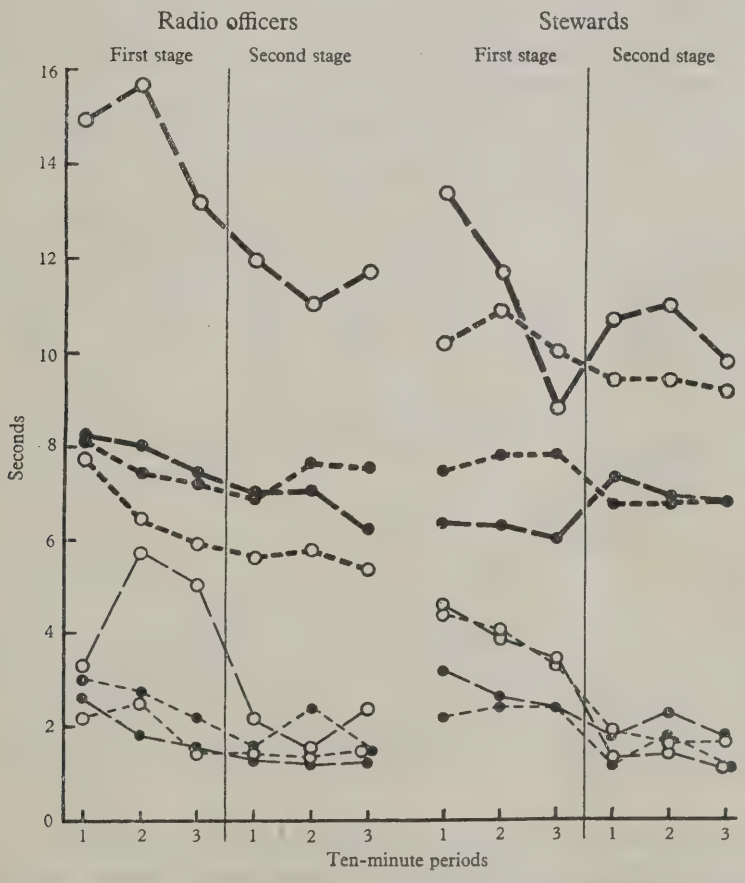

Fig. 6. Grid-matching experiment. Mean times to first attempt and on small errors (per run). Open circles = subjects tired in the first stage of the experiment and fresh in the second. Filled circles = subjects fresh in the first stage and tired in the second. Short-dashed lines = 'easy' trips. Long-dashed lines = 'hard' trips. Thick lines = time to first attempt. Fine lines = time spent on small errors.

(B) *Stewards*

Comparing the results from Stewards with those from Radio Officers, three points seem to be clear:

(1) The performances of the Stewards tested first when fresh are fairly similar to those of the Radio Officers tested first when fresh.

(2) The Stewards tested first on coming in from a 'hard' trip show differences from Stewards tested first when fresh similar to, although somewhat less pronounced than, those found between the comparable groups of Radio Officers, and these differences were found to be significant in respect of the same measures, namely, total activity, number of runs made during the half-hour and 'time to first attempt', all these in both stages of the experiment.

(3) The Stewards tested first on coming in from an 'easy' trip show, in contrast to the corresponding Radio Officers, a performance which in certain important respects approximates to that of the Stewards tested first after a 'hard' trip rather than to that of the Stewards tested first when fresh. In particular:

(*a*) As regards number of runs made, it will be seen from Fig. 5 that they are intermediate between the 'hard-trip' and fresh subjects. The difference between the whole group of Stewards tested first when tired and the whole group tested first when fresh, is significant in both stages of the experiment.

(*b*) Similar significant relations obtain as regards 'time to first attempt' (Fig. 6).

Table 6. *Percentage 'direct hits'*

	Radio Officers				Stewards			
	First fresh		First tired		First fresh		First tired	
	Easy	Hard	Easy	Hard	Easy	Hard	Easy	Hard
1st stage	66·9	78·5	69·9	78·6	72·6	67·4	64·7	76·3
2nd stage	71·3	79·3	73·1	82·8	81·1	74·6	79·2	87·0

With regard to numbers of errors and time spent on errors, the relations of the various groups and subgroups are not so clear. The Stewards tested first after an 'easy' trip show times per run on small errors which are very similar to those of the Stewards tested first after a 'hard' trip in both stages of the experiment (Fig. 6). In the other measures which deal with errors, i.e. number of errors, percentage of 'direct hits' and time per error, the Stewards tested first on return from an 'easy' trip resemble the Stewards tested first when fresh.

It thus appears that these Stewards tested first on return from an 'easy' trip show the slowness of initial placing of the pointer characteristic of those tested first on return from 'hard' trips, without, however, a corresponding slowness in correcting for errors. This finding seems to signify that the Stewards suffer from 'fatigue' regardless of the trip made, but that fatigue resulting from an 'easy' trip is less severe than that resulting from a 'hard' trip.

Additional evidence of the tiredness of the Stewards is contained in the fact that although the phenomenon previously noted among Radio Officers, that performance during the second stage of the experiment tends to be a function of performance during the first, is clearly illustrated in their results, there is some tendency for the Stewards tested first when fresh to show impairment of performance when retested on return from

a 'hard' trip. It will, for instance, be seen that in respect of total events and successes (Fig. 5), while the Stewards tested just before departure on a 'hard' trip do a little better than those going out on an 'easy' trip during the first stage of the experiment, when they are retested on return the advantage is in favour of the latter.

Two further points about the results of this second experiment are worthy of mention. First, the large errors, although they did not yield significant quantitative differences between groups of subjects, showed striking qualitative differences from previous experiments. In the experiments we have carried out with this apparatus in which we have been comparing groups of different ages, large errors have occurred only when the ball has stopped at the right-hand end of the grid and the subject has measured its position from the brass frame of the grid instead of from the co-ordinates as instructed—a procedure which, as will be seen from Fig. 4, will make him about one inch wrong in his placing of the pointer relatively to the upright co-ordinate. In this experiment, the tired subjects made large errors even when the ball was in easy positions, i.e. near the co-ordinates. In cases where the ball was at the right-hand end of the grid, they tended to place it even nearer the upright co-ordinate than it actually was, i.e. they tended to make large errors in the opposite direction from that to be expected if they were measuring from the brass frame of the apparatus. It is difficult to explain this peculiarity except as a complete inability on the part of these tired subjects to achieve an adequate orientation to the task.

The second point to be noted is that most of the subjects coming first to be tested on return from a 'hard' trip and Stewards coming first from 'easy' trips as well, had great difficulty in understanding the instructions. These are very simple, especially when the subject is facing the apparatus and the various parts of it are indicated when they are mentioned. Some of these tired subjects required to hear the instructions as many as three times and still performed the cycle of operations wrongly during the practice period, e.g. they pressed the 'stop' key in attempting to start the ball. This difficulty had not been met previously, and did not occur with subjects taking part in this experiment when they were fresh. In line with this finding, when some of the subjects tested first when tired returned after about 8 days' leave, they required to hear the instructions again in full and had only very vague memories of the cycle of operations they had performed many times over only a few days previously.

Discussion

The results of this experiment present both similarities to, and differences from, those of the first. In particular:

(1) The slowing of performance among those tested first when tired which was seen in the former experiment is present in this also except, however, in the case of the Radio Officers tested first after an 'easy' trip. The fact that these Radio Officers show impairment in one experiment and not in the other suggests that at least milder degrees of fatigue are not general but are confined to particular functions which play a greater part in one task than another.

(2) In the first experiment the Radio Officers tested first after a 'hard' trip took, on the average, about the same time and the same number of meter readings as those tested first after an 'easy' trip, but were markedly less accurate. In this experiment they are no less accurate but very much slower. This result indicates clearly that the effects of fatigue are not uniform from one task to another, and that fatigue may show itself in very different ways in different tasks. The way in which it does show itself would seem to be dependent

upon the demands of the task. In our first experiment the subject was not in any way *constrained* to be accurate, and any difficulty over the task (in this case interpreting the meter readings) would be likely to show itself by way of inaccuracy. In the second experiment the subject had to achieve a considerable degree of accuracy in placing the pointer before he could proceed with the task, and, therefore, any difficulty in carrying out the plotting task could only show itself in slowness or in a larger number of errors. The psychologically significant finding in this experiment is that it was the former of these two modes of behaviour that was adopted by those we had reason to believe were severely fatigued.

(3) The finding that the subjects who showed marked signs of fatigue required to hear the instructions again during the second stage of the experiment suggests that part at least of the impairment of the performance in the second stage of the subjects tested first when tired may have been due to a failure to learn the task during the first stage. This cannot be a complete explanation, however, for if it were so, the performance of these subjects during the second stage should have been the same as that of fresh subjects in the first stage. This is clearly not the case, and it therefore appears that the subjects learned the task during the first stage but learned an inadequate method which became fixated.

The increased activity of the subjects whom we had reason to believe were only slightly fatigued, i.e. the Radio Officers who had returned from 'easy' trips, and the striking slowness of the subjects whom we had reason to regard as more severely fatigued, i.e. the Stewards and the Radio Officers from 'hard' trips, suggests an interesting parallel with the results of Davis (1948) who found a tendency among R.A.F. pilots during a 2 hr. test for breakdown of skill in an artificial aircraft cockpit to show first as a large number of small errors and later as a smaller number of errors of longer duration. Davis explained his results in terms of increasing anticipatory tension due to fear of failure to carry out the experimental task adequately, which again suggests a possible link with our own experiments, in that poor performance during the first stage of the experiments tended to be followed by similarly poor performances during the second, and that in the first experiment the pattern of results from Radio Officers about to go out on a 'hard' trip tended to be similar to that from Radio Officers who had just come in from a trip of the same kind.

Although this similarity of findings is suggestive, it must be remembered that

(*a*) Davis's findings were obtained in the course of a 2 hr. session, while ours were measures obtained in about half an hour of effects which were the result of a week or more of flying.

(*b*) While the parallelism as regards the relation of over- and under-activity to degree of 'fatigue' holds in the case of our second experiment, in the first experiment the pattern presented by Radio Officers tested first after a flight is of slowness at producing solutions to the problems but not of under-activity, e.g. they take more readings on the resistance meter than do those tested first when they are fresh.

(*c*) The degree of activity shown by the Radio Officers, tested first after a 'hard' trip, was considerably less in the second experiment than in the first, so that it does not seem satisfactory to conceive of over-activity or under-activity phases as affecting the whole of behaviour evenly at any particular time. Rather the incidence of such phases would seem to be to some extent dependent upon the nature of the experimental task. The tasks we used were both objectively and psychologically different from that of the cockpit. In particular, while changes in the display of instruments in the cockpit to which the subjects' responses had to be made were intitiated by the machine, the pacing of both our tasks was entirely under the subjects' own control.

While these differences between Davis's experiments and our own do not exclude the possibility that similar mechanisms are at work in both cases, they appear sufficient to make it undesirable to press the similarity very far until more evidence is available than exists at present about the relation between changes of performance at skilled tasks in the course of short and long periods of exercise, and about the transferred effects of long exercise at one task upon the performance of others.

D. Concluding note

The results of these two experiments suggest strongly that:

(1) There is measurable deterioration in the performance of some members of aircrew engaged in civilian flying, of at least some tasks met for the first time at the end of a flight.

(2) When this flight has been an 'easy' one, the deterioration may be relatively slight, and indeed some aspects of the performance may actually be improved.

(3) When, however, the flight has been a 'hard' one, the deterioration may be very severe. The results indicate that it takes the form of a general slowness of performance accompanied by an increased difficulty in dealing with presented data.

(4) The impaired performances of subjects meeting tasks for the first time when they are tired tend to be repeated on meeting the tasks for a second time when they are fresh, probably owing to the fixation of an inadequate method when fatigued.

(5) Conversely, subjects meeting tasks for the first time when they are fresh show little if any impairment of performance on meeting them for a second time, even when they appear to be severely fatigued.

Elucidation of the causes of these results must wait on further work, but initially it would seem that research should be directed to the assessment of the respective roles of the following:

(1) *Tension.* Many of the men returning from flights showed signs of tenseness. This kind of over-activity does not, however, show itself in the test performances in general, although it appeared from observation of the subjects to be partly responsible for the larger number of readings taken in solving the electrical problems. In any case, it is by no means clear how far this kind of tension is likely to cause serious deterioration of performance unless it becomes very great.

(2) *Lowered excitability.* The flying of an aircraft is a task which demands an effort of vigilance over long periods with comparatively little in the way of concrete evidence of the results of this effort. Such a task is likely to lead to a lowering of standards of performance and to a form of 'mental inertness' which would fit well with many of the results of our experiments. While, however, on general grounds such a theory could plausibly account for the deterioration of performance of Radio Officers, it seems difficult to apply to Stewards. It is relatively easy to see how this type of fatigue might affect those crew members whose task it is to fly and direct the aircraft to its destination, but it is less easy to see why it should affect crew members whose task is the more immediate one of serving meals, etc., and attending to the wants of passengers during the period of the flight.

(3) *Anoxia.* The slowness of performance and difficulty of dealing with data suggest that some at least of the deterioration of performance we have found may be the result of the after-effects of anoxia due to flying for long periods at or above 10,000 ft. The likelihood of this explanation would seem to be dependent upon the length of time these after-effects could continue. In particular, if it is to explain the greater deterioration of performance by those returning from 'hard' as opposed to 'easy' trips, it is necessary either

to assume that it is cumulative over a matter of days but largely dissipated by night stops, or to regard it as a secondary effect of some factor such as tension, i.e. if those on 'hard' trips are more tense than those on 'easy', they will tend to expend more energy and thus become more anoxic.

(4) *Physical exhaustion*—either as a primary effect of working hard over a long period or as a secondary effect of tension or anoxia. The general slowness of performance noted in our results would seem plausible on this view, especially in the case of Stewards, but if this explanation is valid, it seems reasonable to suppose that fatigue effects would show clearly on physiological tests. We understand that when such tests have been tried, the effects to be expected on this view have not appeared to any marked extent.

(5) *Loss of sleep.* Any 'tight' flying schedule is likely to lead to some disturbance of sleep, and, as mentioned earlier, an investigation carried out with the grid-matching apparatus previous to the present experiment had suggested that loss of sleep brought about a deterioration of performance at that task. It seems possible, therefore, that some of the changes observed in our subjects returning from 'hard' trips may be due to this cause, but unfortunately the information obtained in the former investigation was insufficient for us to say that the changes were of a similar kind. In any case, loss of sleep would seem to be an insufficient explanation for the difference between the performances of Radio Officers and Stewards tested first after 'easy' trips.

It is clear that no one of these possibilities seems likely by itself to provide a sufficient explanation of the changes of performance we have noted, and that further work should therefore aim not at finding some one cause but at assessing the contributions of the several different causes or factors probably involved. Some indication of these might well be obtained by comparing runs of different kinds, in particular:

(1) It might be expected that tension would tend to be high on those runs which involve flying long distances over sea, or on which the ground communications are poor.

(2) Lowered excitability is likely to be greatest on those runs on which long distances are covered in single 'hops'.

(3) Some indication of the part played by anoxia in real flying conditions, as opposed to those of a decompression chamber, could be gained by comparing runs on which pressurized aircraft are used with those using unpressurized aircraft, although the adequacy of pressurizing at the equivalent of 8000 ft. (as normally used) against chronic mild anoxia requires to be proved.

(4) Both physical exhaustion and lowered excitability are likely to be great on runs where long distances are covered and rests are short.

(5) Loss of sleep is likely to be greatest when the schedule is such that rest periods are not only short but occur at times which are outside the normal sleeping hours. In this respect north and south flights are likely to be easier than east and west. Valuable information could also be obtained by comparing performances after trips on which full use has been made of the opportunities provided for sleep with those after trips during which rest periods have been employed largely in waking activities.

As regards the technique of investigation it is clear that the testing of the crews before and after flight leaves much to be desired. All the possible causes of deterioration of performance that we have suggested, with the exception of physical exhaustion and loss of sleep, are likely to be lessened, if not very largely dissipated, as soon as the plane has landed at the end of its trip. It seems, therefore, of importance that data should be obtained from crews while they are actually in flight. Ideally, objective measures should be

taken of performance at the actual operations crew members normally carry out, although valuable preliminary information could probably be obtained by simpler methods, such as the giving of tasks similar in type to those we have used in our experiments, or the observation by suitably trained persons of crews while in flight.

E. Summary

Experiments carried out on civilian air crew with a view to studying the effects on complex skilled performances of fatigue resulting from flying gave the following results:

(1) *Electrical problems:*

(*a*) Radio Officers tested on return from a trip took longer and required more data to solve the problems than did those tested after a stand-down of at least 8 days.

(*b*) When the trip had been a 'hard' one, their solutions were markedly less accurate than when the trip had been an 'easy' one.

(2) *Plotting task:*

(*a*) Radio Officers and Stewards tested on return from a hard trip showed a performance which was no less accurate but markedly slower than that of subjects tested after stand-down.

(*b*) Similar impairment of performance was not found in the case of Radio Officers tested on return from an easy trip.

(*c*) Stewards tested on return from an easy trip showed a performance intermediate between that of Stewards tested after a hard trip and those tested after stand-down.

(3) *Performances when tested a second time:*

(*a*) The impairment of performance shown in subjects tested first after a trip appeared also when they were retested after at least 8 days' stand-down.

(*b*) Conversely, subjects initially tested after stand-down showed no impairment of performance when subsequently retested after a trip.

It appears, therefore, that measurable impairment of performance is likely to occur at tasks met for the first time when fatigued, but that little or no impairment occurs when the tasks have been met previously in a non-fatigued state.

The extent of the impairment appears to vary somewhat from one function to another, and the way in which impairment manifests itself appears to depend in part upon the demands made by the task upon the performer.

Suggestions are made for further research.

Our thanks are due to Prof. Sir Frederic Bartlett and to Sir Harold Whittingham for many valuable suggestions. We wish also to acknowledge the generous co-operation of the B.O.A.C. staff at Berth 50, Southampton, and at Hythe, and of the air crew who acted as subjects in the experiments.

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SPEED AS A FUNCTION OF DISTANCE: AN ANALYSIS OF ROAD-CYCLING PERFORMANCES

By NORRIE WARD, *Leeds*

I. *Purpose of inquiry* (p. 212). II. *Procedure in trials* (p. 212). III. *Collection of data* (p. 212). IV. *Comparison of performances at different distances* (pp. 213–214). V. *Regulation of speed during actua performance* (pp. 214–215). VI. *Conclusions* (p. 215). *Appendix* (pp. 215–216). *References* (p. 216).

I. Purpose of inquiry

1. It is thought that the assessment of human working capacity might be aided by a study of performances in athletic competitions.

2. In these notes, an effort is made to review results of road-cycling competitions.

II. Procedure in trials

3. In road-cycling trials, each competitor rides entirely alone. His purpose is to ride a given distance in the shortest possible time, or to cover the greatest possible distance in a given time. The conditions under which he competes enable him to make his effort in his own way.

4. The times recorded represent the full time taken by the rider, including any time off the machine for rest or other purposes. Sometimes riders continue their effort without pause (over 250 miles have been covered without dismounting), but some dismount for a few minutes in the longer distance events, presumably planning to regain the time so 'lost' by subsequently riding faster than they might otherwise have done had they not stopped.

5. It is a reasonable conclusion that the best times have been recorded by men making, in their own way, the maximum effort of which they felt themselves capable.

6. The distances covered are from 25 to 450 miles; times range from 1 to 24 hr. In all cases, the rides are on 'out and home' courses, finishing close to the starting-point.(1)

III. Collection of data

7. Since 1930 there has been held in this country a national competition based on the best performances recorded by each rider in any one season at 50 and 100 miles and 12 hr.

8. Such performances are recorded on many different courses, some of which are 'faster' than others, and under varying weather conditions, which affect speed. The leading performances each year, however (being selected from many rides by each man in each year), represent work done under the most favourable conditions each man has encountered.

9. To arrive at 'average' performances, the arithmetical means of some sixty-nine sets of performances at the three standard distances(2) have been calculated. These are:

50 miles	2 hr. 11 min. 48 sec.
100 miles	4 hr. 40 min. 48 sec.
12 hr.	233·25 miles

IV. COMPARISON OF PERFORMANCES AT DIFFERENT DISTANCES

10. When these average performances are plotted, it is difficult to find a theoretical relation between them in the usual terms of space (s) and time (t) which satisfies all the requirements. They fall upon a curve where the relation between distance (space covered) and time is

$$s = at + bt^2 + ct^3,$$

where a, b and c are constants, but this curve does not meet the case for performances at distances below 50 miles or times above 12 hr.

11. A simpler relation can be found when time is considered as a function of distance. A useful basis of comparison between the performances is provided by the times per mile:

50 miles	0·04394 hr. per mile
100 miles	0·04680 hr. per mile
12 hr.	0·05140 hr. per mile

12. When plotted, these data enable an empirical relation to be deduced. They are found to lie close to a curve $y = m + n\sqrt{x}$ such that

$$\text{Hours per mile} = m + n\sqrt{\text{distance}}.$$

13. From the data shown at para. 11, the constants m and n are found by calculation to be approximately 0·0376 and 0·0009 respectively.

14. Using these calculated values, the empirical formula gives:

50 miles	0·043963 hr. per mile (2 hr. 11 min. 52 sec.)
100 miles	0·046600 hr. per mile (4 hr. 39 min. 36 sec.)
12 hr.	0·051352 hr. per mile (233·5 miles)

15. There are further figures by which the relation can be tested (3). These are the best performances on record at each distance (not necessarily by the same rider). At present these are:

25 miles	58 min. 0 sec.	0·03860 hr. per mile
50 miles	1 hr. 59 min. 14 sec.	0·03950 hr. per mile
100 miles	4 hr. 17 min. 2 sec.	0·04284 hr. per mile
12 hr.	251·875 miles	0·04764 hr. per mile
24 hr.	454·375 miles	0·05282 hr. per mile

16. The 50 miles performance appears to be exceptional by comparison with the rest. With this exception, the figures correspond quite closely to figures calculated by using values for m and n (0·03463 and 0·00083 respectively) equal to 0·921 of the average values (para. 13 above):

25 miles	58 min. 9 sec.	0·03878 hr. per mile
50 miles	2 hr. 1 min. 30 sec.	0·04050 hr. per mile
100 miles	4 hr. 17 min. 34 sec.	0·04293 hr. per mile
12 hr.	251·25 miles	0·04779 hr. per mile
24 hr.	458 miles	0·05239 hr. per mile

17. The longest continuous effort on record is the present record from Land's End to John o' Groats (870 miles). The route is considerably more difficult than courses normally used in the trials referred to above, but more help from a following wind might be secured on such a one-way course. It is unlikely that a favourable wind would entirely equalize conditions.

18. Using the values shown at para. 16 above, the formula gives a time of 2 days 3 hr. 25 min. for 870 miles. The best time on record is 2 days 6 hr. 33 min. (4).

19. Road trials are not held at distances of less than 25 miles. Shorter distances are ridden, under more favourable conditions, on racing tracks. A comparable figure for 1 mile is the British amateur track record. This is 2 min. 1·2 sec. (5). The time for 1 mile calculated from the values given at para. 16 above is 2 min. 7·2 sec.

20. From this survey it might reasonably be concluded that within certain limits there is a relation between the time taken to carry out a certain process (riding a bicycle one mile in the examples given) and the number of times the process has to be repeated. It would seem that there is an absolute minimum time in which the process can be performed, and that the time for each repetition will increase by an amount approximately proportional to the square root of the number of times the process has to be repeated.

21. The values of the constants m and n used above are representative of the general case. In individual cases they may well vary. Some men are capable of achieving fast times at short distances, but their capacity for continued effort falls off more rapidly than in the general case. Conversely, some who can cover great distances in record time lack speed at shorter distances. Performances of such riders, however, still appear to fall upon the curve $y = m + n\sqrt{x}$ when appropriate values are used for the constants.

V. Regulation of speed during actual performance

22. Reliable evidence as to the normal variation of speed during a performance is difficult to secure. In the case of a 50 miles trial, ridden on a course 25 miles out and 25 miles home, the half-way times are greatly affected by the prevailing wind. In a longer distance event such as a 12 hr. trial (in which 'legs' of the course do not normally exceed 25 or 30 miles), the influence of the weather is not so apparent on intermediate times at, say, 50, 100, 150 and 200 miles. Figures found by examining 100 performances in seven events over a period of several years (6) suggest, both individually and collectively, that speed falls off quite smoothly and steadily, and much more gradually (from a slower start) than do the speeds at separate distances. Thus when riding 100 miles the average rider does not ride the first 50 in 2 hr. 11 min. and the next in 2 hr. 29 min. to accomplish a time of 4 hr. 40 min. It appears he is more likely to ride the first 50 in about 2 hr. 17 min. and the second in 2 hr. 23 min. Similarly, when riding for 12 hr. he will take something like 14 min. longer for the first 100 miles than he would if he were riding only 100 miles. Results of a similar character have been found in investigations by David Katz (7). In both the addition of figure series and in running performances it was found that the time for the first part of the performance increased progressively as the magnitude of the task to be performed was increased. Unfortunately, Katz's investigations covered only the first 10 figures in the addition of columns which were increased successively to 20, 30, 40, 50 and 60 figures, and only the first 60 m. in running performances at distances of 120 and 180 m. In the absence of times taken at additional intermediate points it is not

possible to determine the progressive deterioration in speed, but the investigations confirm the general conclusion that a slower start will be made when facing a longer or greater task. (A further note on one of Katz's experiments is given in the Appendix.)

23. The average intermediate times in the cycling performances under review are:

Miles	Hr.	Hr. per mile
50	2·395	0·04790
100	4·909	0·04909
150	7·530	0·05020
200	10·224	0·05112
233·5	12·000	0·05140

24. These figures suggest a fairly uniform rate of negative acceleration between 50 and 200 miles. In the earlier stages it seems there is a rather greater loss of speed, and in the later stages it seems that the loss of speed is arrested slightly.

25. An approximate expression for the average figures is

$$\text{Distance} = 20{\cdot}9t - \frac{0{\cdot}25t^2}{2},$$

but a somewhat closer correspondence is given by

$$\text{hr. per mile} = 0{\cdot}0446 + 0{\cdot}00045\sqrt{\text{distance}}.$$

Thus

Miles	Average hr. per mile	$m + n\sqrt{d}$ hr. per mile	$ut - \frac{1}{2}at^2$ hr. per mile
50	0·0479	0·0478	0·0486
100	0·0491	0·0491	0·0492
150	0·0502	0·0501	0·05006
200	0·0511	0·0510	0·0510
233·5	0·0514	0·05146	0·0514

VI. CONCLUSIONS

26. It appears from the foregoing that the maintenance of a constant speed, over any considerable period of time, is not to be expected, but that the loss of speed in performing any particular task will, in the case of an experienced performer capable of spreading his available energy over the task in hand, be gradual throughout the performance. It appears that an experienced performer adjusts his initial speed according to the task to be performed, and that although he may be capable of higher speeds, he does not attempt to achieve these when facing tasks of considerable duration. The manner in which he adjusts his effort suggests that experience has shown him that any attempt to achieve his maximum speed over the initial stages will result either in failure to complete the task or in an ultimately greater overall time. It would appear that he seeks to expend his available energy as smoothly as possible over the whole of his task, and strives to put out a constant effort.

APPENDIX

Note on investigations by David Katz(7)

Katz records (Experiment 4) the average times taken by four people in adding columns of 10, 20, 30, 40, 50 and 60 figures as follows:

Figures	Time in sec.
10	7·4
20	18·9
30	30·5
40	44·0
50	57·5
60	74·1

In the course of adding 10 figures, nine processes are necessary; in adding 20, nineteen processes are necessary, and so on. As the timing did not start until the first process had been completed, the Katz experiments actually recorded the time for only eight processes in the first group of 10 figures, and from his figures the following data are obtained:

Processes	Sec.	Sec. per process
8	7·4	0·925
18	18·9	1·050
28	30·5	1·089
38	44·0	1·158
48	57·5	1·198
58	74·1	1·278

When the times per process are plotted, it is seen that their scatter (which is slight, and within the possible errors of timing to such fine limits) is about a curve

$$y = m + n\sqrt{x},$$

identical in character with the empirical curve deduced from the figures for cycling performances. (The actual curve is: sec. per process $= 0{\cdot}7514 + 0{\cdot}0666\sqrt{}$(number of processes).)

The number of performances in Katz's experiments, however, is comparatively small, and the difference in the range of times covered (7·4–74·1 sec. as against 1–24 hr.) is very considerable.

Without more conclusive evidence it would be unwise to regard these widely differing sets of data as establishing a relation between the rate of loss of speed in carrying out mental and physical work. The possibility of such a relation is, however, seen to exist, and this may suggest a field for further useful investigation.

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VARIATIONS IN THE PERFORMANCE OF SOME AESTHETO-KINETIC TESTS*

By J. R. MANNING

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I. *Introduction* (p. 217). II. *The Test machines* (pp. 217–219): (*a*) *Descriptions* (pp. 217–218); (*b*) *Comments* (pp. 218–219). III. *Results and Preliminary Analysis* (pp. 219–223): (*a*) *Statement of Results* (pp. 219–221); (*b*) *Combination of Scores* (pp. 221–222); (*c*) *Distribution of Combined Scores* (pp. 222–223). IV. *Variations in Test Scores* (pp. 223–225): (*a*) *Variations with Occupation* (p. 223); (*b*) *Correlation with Age* (p. 223); (*c*) *Effect of Driving Ability and Response to Questionnaire* (p. 224); (*d*) *Correlation with Driving Experience* (p. 224); (*e*) *Association with Left-handedness* (p. 225); (*f*) *Association with Time and Place* (p. 225). V. *Summary* (pp. 225–226).

I. Introduction

The Industrial Health Research Board of the Medical Research Council did considerable work before the war on the development of tests for accident proneness. The tests were used chiefly in the study of accident proneness among factory workers, although there was also some application to motor drivers (Farmer & Chambers, 1939). The instruments developed by the Board have been placed at the disposal of the Road Research Laboratory, which since the war has been collaborating with the Medical Research Council in research into road safety and traffic flow, and the opportunity has been taken of applying the tests to 217 members of the staff of the Laboratory, with the object of studying the effect of age, sex and other qualities on performance in the tests. Information concerning experience in road accidents was also requested from the subjects, but the results were too scanty to justify inclusion in this analysis. In any case, Farmer & Chambers (1939) have shown that correlations between accident rates and test scores can only be demonstrated in groups of drivers of equal age and experience.

II. The test machines

(*a*) *Descriptions*

Three mechanical instruments have been developed. They are all of the aestheto-kinetic type, i.e. the subject has to manipulate certain controls in accordance with visual and aural signals which he receives. Brief descriptions of these tests are as follows:

(1) *Hand and eye co-ordination* (Farmer & Chambers, 1929)

A brass button with a white centre is moved in an irregular (but predetermined) path by a governed gramophone motor. A green button is fixed to a carriage borne on two horizontal perpendicular screw threads so that it moves in a plane about $\frac{1}{4}$ in. above that of the brass button, and its position is controlled by two handles. The subject is told to manipulate these handles so as to keep the green button exactly over the brass one. After 104 sec. a brake is automatically applied. A recording device indicates the score (a) obtained by the subject, a low score being good. If the test is done perfectly, $a=0$.

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(2) *Triple tester*

This was devised by the late Dr K. J. W. Craik and has not previously been described. The surface of a cylindrical drum with its axis horizontal is divided by a blue line into a helical band. Along this band are numerous brass buttons which come into view successively as the drum is rotated by an electric motor.

The subject holds a wheel connected by a rack and pinion with a brass knob which rests in contact with the drum; by turning the wheel he can move the knob parallel to the axis of the drum. Each time the knob touches a button an electrical circuit is completed and a counter is operated. The subject is told to contact as many buttons as possible without letting the knob cross the blue line.

The machine can be modified in three ways:

(i) The speed of the drum can be altered.

(ii) A cover can be placed over the drum so that the subject is unable to see the buttons until they approach close to the knob.

(iii) By an ingenious device, the control wheel can be made to move the knob indirectly, via a friction wheel which moves across a disk driven at constant speed. Thus the velocity is directly controlled, and the position indirectly.

The score obtained is the number of buttons contacted. (*b*) is the score with direct control, fast speed and the cover in position, (*c*) is the score with indirect control, slow speed and the cover off.

For each test the maximum possible score is 206.

(3) *Interrupted pursuit meter*

This machine was devised by Dr Edgar Schuster, and the test requires the subject to perform two kinds of action simultaneously. A small white button moves irregularly to and fro along a circular arc, while a second white button can be moved along a concentric arc by a lever held by the subject. He must try to keep the two buttons in line.

At the same time the subject receives a succession of visual and aural signals. There are four different signals used:

(i) a red light,

(ii) a white light,

(iii) a bell,

(iv) a buzzer.

With his left hand, the subject controls two switches, each of which has three positions, the central one being the normal 'off' position. The four 'on' positions correspond to the four types of signal. Each signal lasts for less than a second, and on receiving it, the subject must immediately move the appropriate switch to the appropriate position. If he does this promptly, i.e. before the signal is cut off, he scores a point.

A counter indicates the total number of prompt responses [(*d*), maximum = 20] while a separate device indicates a pursuit score [(*e*), best possible = 0].

(*b*) *Comments*

(1) The scoring mechanism on the first hand-and-eye co-ordination machine records whenever the distance between the two buttons is increasing; it might be an improvement if it were to integrate the distance between the two buttons with respect to time.

(2) The triple tester seems satisfactory.

(3) The two switches on the interrupted pursuit meter are about 5 in. apart. Thus a person with large hands probably has an advantage because he can grip both switches at once instead of having to leap from one to the other.

A disadvantage of the pursuit mechanism is that the subject obtains a good score of about 125 (see Fig. 5) if he does not move the pursuit knob at all, so that better scores may be obtained by those who make least effort to follow the moving button.

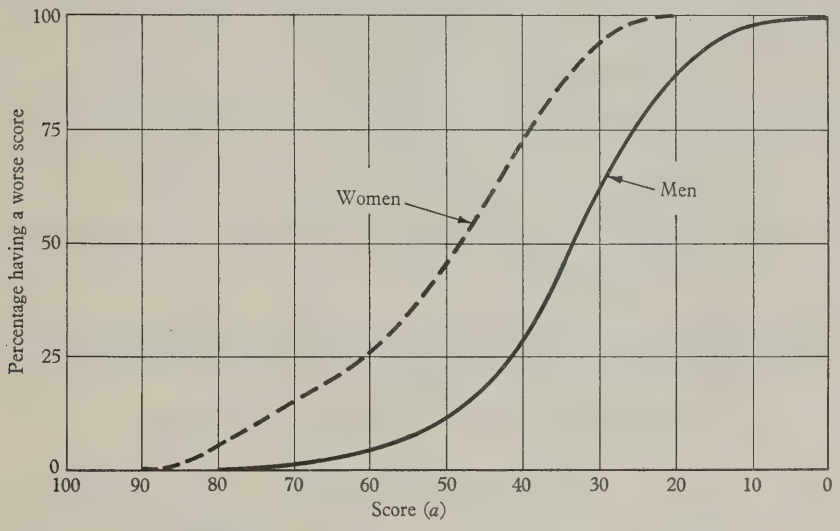

Fig. 1. Hand and eye co-ordination. Scores of R.R.L. Staff.

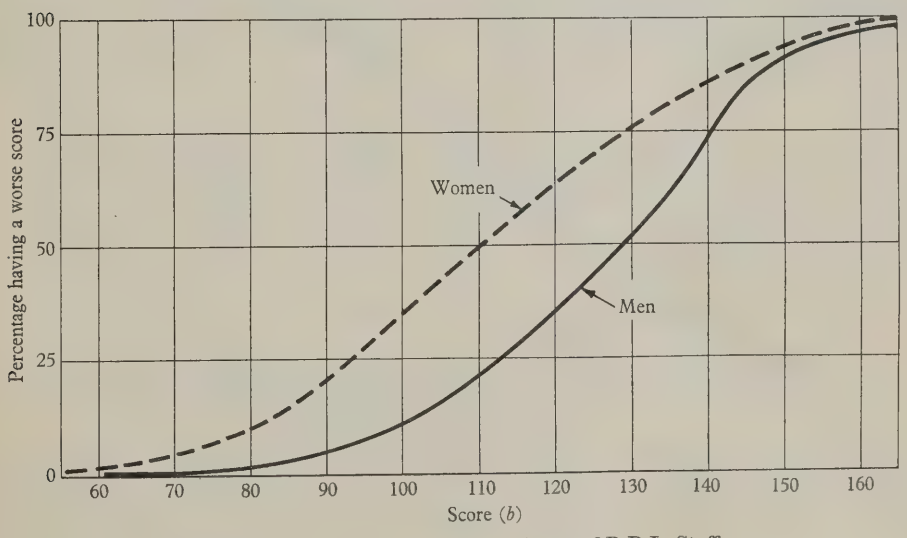

Fig. 2. Triple tester (direct control). Scores of R.R.L. Staff.

III. Results and preliminary analysis

(a) *Statement of results*

The tests were given to 164 men and 53 women. Each subject was allowed one practice run on each machine before the test was given, and the tests were always presented in the same order. The distribution of the five scores are shown for men and women separately

in Figs. 1–5. Table 1 shows the means and standard deviations of the five scores for men and women separately.

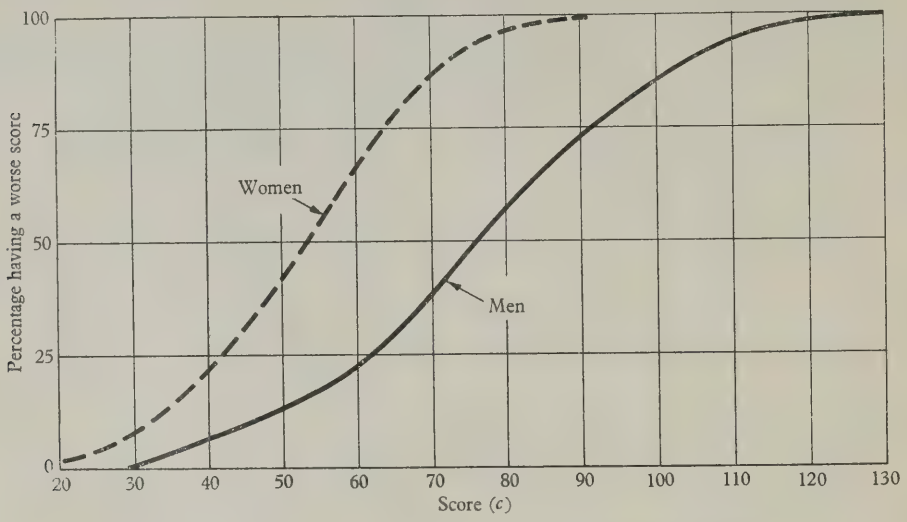

Fig. 3. Triple tester (indirect control). Scores of R.R.L. Staff.

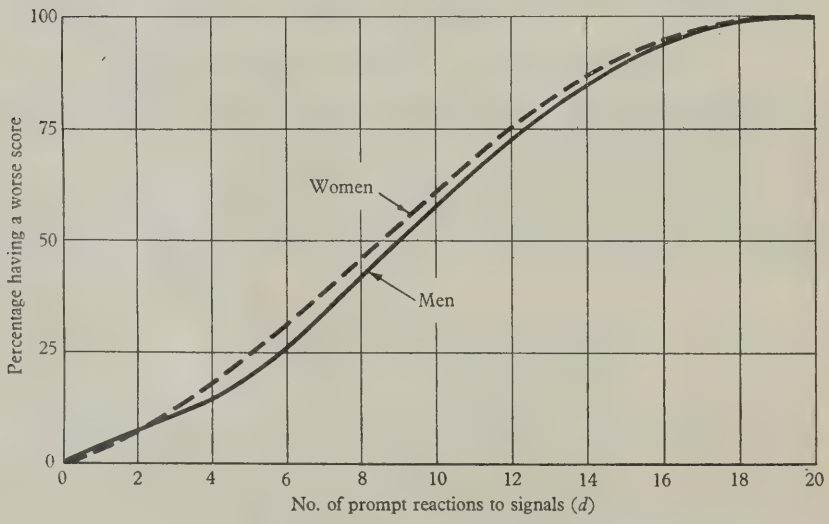

Fig. 4. Interrupted pursuit meter. Scores of R.R.L. Staff.

Table 1

		Men			Women			
Test score	High score is	No.	Mean score	Standard deviation	No.	Mean score	Standard deviation	*t*
(*a*)	Bad	164	35·2	13·0	53	51·9	15·8	7·68
(*b*)	Good	164	126·4	20·6	53	112·1	24·9	4·16
(*c*)	Good	164	76·7	22·2	53	53·7	16·5	6·97
(*d*)	Good	164	8·6	4·6	53	8·2	4·5	0·49
(*e*)	Bad	163	155·2	29·1	53	171·7	54·9	2·85

For (*a*), (*b*), (*c*) and (*e*) the men tested had significantly better scores than the women, as is clear from the figures or from the values of Student's '*t*' in the last column of Table 1.

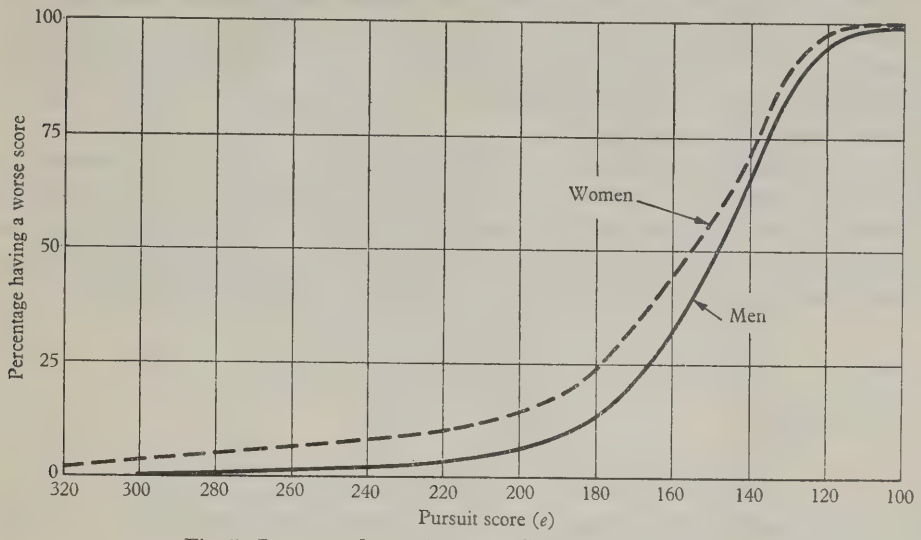

Fig. 5. Interrupted pursuit meter. Scores of R.R.L. Staff.

(*b*) *Combination of scores*

If the tests all measure (partly at least) the same ability, we should expect a tendency for people who did well on one test to do well on the others. The mutual correlations between the scores have been computed for men and women separately and are shown below in matrix form:

Men

	(*a*)	(*b*)	(*c*)	(*d*)	(*e*)
(*a*)	1	−0·464	−0·451	−0·380	+0·099
(*b*)	−0·464	1	+0·461	+0·401	−0·044
(*c*)	−0·451	+0·461	1	+0·366	−0·120
(*d*)	−0·380	+0·401	+0·366	1	−0·120
(*e*)	+0·099	−0·044	−0·120	−0·120	1

(A)

Women

	(*a*)	(*b*)	(*c*)	(*d*)	(*e*)
(*a*)	1	−0·280	+0·067	−0·344	+0·285
(*b*)	−0·280	1	+0·482	+0·524	−0·030
(*c*)	+0·067	+0·482	1	+0·321	−0·069
(*d*)	−0·344	+0·524	+0·321	1	+0·066
(*e*)	+0·285	−0·030	−0·069	+0·066	1

(B)

The sign of every term in the men's correlation matrix points to the conclusion that a man skilful at one test is skilful at them all. The matrix (A) is hierarchical, each correlation $r_{jk}(j \neq k)$ being expressible as a product $r_j . r_k$, and it can be idealized thus to conform exactly with this relation:

		r_a −0·674	r_b +0·700	r_c +0·659	r_d +0·564	r_e −0·141
r_a	−0·674	1	−0·472	−0·444	−0·380	+0·095
r_b	+0·700	−0·472	1	+0·461	+0·395	−0·099
r_c	+0·659	−0·444	+0·461	1	+0·372	−0·093
r_d	+0·564	−0·380	+0·395	+0·372	1	−0·080
r_e	−0·141	+0·095	−0·099	−0·093	−0·080	1

(C)

None of the terms in (C) is significantly different from its corresponding term in (A); the standard error of a single correlation coefficient is given by $(1-r^2)/\sqrt{n}$ which is of the order of 0·07 for $n=164$ and $r=0{\cdot}4$, while the greatest difference between terms in the two matrices is 0·055 (for r_{be}). The women's matrix, however, cannot be forced into the same mould or a similar one; in particular, there is a difference of 0·511 which cannot be attributed to sampling variations between r_{ac} for women and for ideal men. Both r_{ac} and r_{de} for women have the wrong sign.

Each r_j can be considered as representing the correlation between a test result and some quality which the tests all measure. Then the best linear combination of tests for measuring this particular quality is given when the coefficients of the test results are proportional to $r_j/\sigma_j(1-r_j^2)$, where σ_j is the standard deviation of the jth test scores. The correlation (R) between the combined score and the quality measured is then maximized and

$$\frac{R^2}{1-R^2}=\Sigma\frac{r_j^2}{1-r_j^2}.$$

In this example

$$\frac{R^2}{1-R^2}=3{\cdot}048$$

$$R=0{\cdot}868.$$

The value of each test in assessing the quality measured by all the tests is indicated by the magnitude of its contribution to $R^2/(1-R^2)$.

Table 3. *Comparison of tests*

Test score	$\frac{r^2}{1-r^2}$	Test
(*a*)	0·832	Hand and eye co-ordination
(*b*)	0·961	Direct } triple tester
(*c*)	0·768	Indirect } triple tester
(*d*)	0·467	Interrupted pursuit meter
(*e*)	0·020	Interrupted pursuit meter
F	3·048	

The interrupted pursuit meter is the least satisfactory in that it correlates least with the other tests, while the direct triple tester is the best or 'most typical' test.

The formula for the combined score is

$$F=K\sum_j\frac{r_jx_j}{\sigma_j(1-r_j^2)} \quad (x_j=\text{score on } j\text{th test}).$$

We take $K=19{\cdot}1$ for convenience and to make one of the coefficients unity, so that

$$F=-1{\cdot}81a+1{\cdot}27b+c+3{\cdot}43d-0{\cdot}09e.$$

(*c*) *Distribution of combined scores*

The values of F will be called F-scores, and their distribution is plotted in Fig. 6 on probability paper. The distributions for men and women are approximately normal and have standard deviations of 66·9 and 66·1 respectively. There is excellent agreement with the theoretical value for men of

$$\frac{KR}{1-R^2}=67{\cdot}1.$$

The maximum possible F-score is 536, the top score obtained was 357, and the bottom was -37.

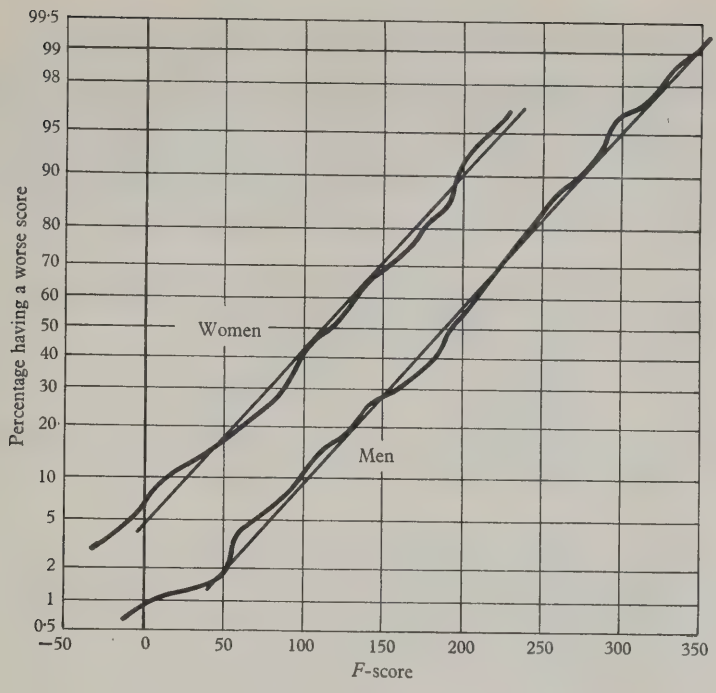

Fig. 6. Combined test scores of R.R.L. Staff.

IV. VARIATIONS IN TEST SCORES

(*a*) *Variations with occupation*

The subjects have been grouped according to their Civil Service grading, and the mean scores in each group are set out in Table 2.

It is clear that unskilled workers have the lowest average score; indeed, in the statistical sense, their score is significantly lower than that of every other group. No other difference between groups is statistically significant, but, nevertheless, there appears to be a tendency for scores to be greater at the higher levels of the Civil Service structure.

(*b*) *Correlation with age*

A note of the scores obtained by each person tested was sent to him (or her), together with a request for information regarding his driving ability and experience, the accidents he had been involved in and his age. The results in the remainder of this note are based on the replies to the questionnaire, but the information concerning accidents was too scanty to be worth including.

The ages of 70 of the men (excluding unskilled industrial staff) are available. The correlation between F-score and age is $-0{\cdot}240$; thus older people get poorer scores, the regression line being

$$F = 267{\cdot}6 + 1{\cdot}817x,$$

where x is the age in years. A parabolic regression line is no better fit.

Only eleven women replied to the questionnaire, two of whom were drivers, and it was not considered reasonable to attempt to draw any conclusions from so small a sample.

(c) *Effect of driving ability and response to questionnaire*

Sixty-one men (excluding unskilled industrial staff) replied that they could drive a motor vehicle, and it is known that at least eleven more can do so; thirteen men stated that they could not drive. The mean *F*-scores of the drivers and non-drivers were 211·1 and 184·6 respectively, the difference being statistically significant at the 20% level ($t = 1{\cdot}38$). Table 4 exhibits these mean *F*-scores together with the numbers of men on which they are based.

Table 4. *Mean F-scores and numbers in groups. Men (excluding unskilled industrial staff)*

	Replied to questionnaire	Did not reply to questionnaire	Total
Drivers	213·1 (61)	199·5 (11)	211·1 (72)
Non-drivers	184·6 (13)	—	184·6 (13)
Total	208·1 (74)	185·5 (76)	196·7 (150)

There is a significant difference between the scores of the men who replied and those who did not ($t = 2{\cdot}24$, significant at 5% level). There is probably a significant difference between drivers and non-drivers who replied ($t = 1{\cdot}52$, significant at 20%)* but not between drivers who replied and drivers who did not ($t = 0{\cdot}67$).

The most likely inference from these facts is that the response to the questionnaire is better from drivers than from non-drivers. This is to be expected for two reasons: first, drivers are likely to have more interest in the problem, and secondly, people generally do not realize the importance of negative answers to questions. A non-driver answering the questionnaire would have to write 'no' or 'none' in every space; he might consider this procedure a waste of time and not bother to complete the questionnaire. Thus if we accept the fact that drivers have better scores than non-drivers we can say that the mean score of the group of non-repliers is low because non-drivers predominate in the group, while that of the group of repliers is high because repliers are mostly drivers.

Furthermore, there may be an artificial selection of drivers; the response would be expected to be better from persons with high scores who feel that they have nothing to lose by admitting their accidents.

To put it another way, the persons least likely to reply are those with bad scores and bad accident records, and there will be some of these even if there is no association between score and accident rate. This will tend to create a negative association between score and accident rate in the group of driver-repliers.

Taken all together, the figures indicate an association between driving ability and *F*-score in the sense that drivers have better scores than non-drivers.

(d) *Correlation with driving experience*

The correlation coefficient (0·100), between *F*-score and mileage driven in 10 years (for driver-repliers) is not significant at the 20% level.

* If the effect of age is taken into account, the difference appears more significant. The mean age of the replying drivers was 32·3, and of the replying non-drivers, 27·8. On this basis alone, the difference in the mean *F*-scores would be expected to be −8·2 instead of +28·5.

(*e*) *Association with left-handedness*

The controls for test *d* are worked with the left hand, that for *e* with the right hand, while both hands are used equally for *a*. For tests *b* and *c*, either or both hands may be used, but the control wheel is on the left of the machine.

Three men who did the tests are known to be left-handed and they obtained the mean scores shown in Table 5.

Table 5. *Mean scores of three left-handed men*

Test score	*a*	*b*	*c*	*d*	*e*	*F*
Left-handed men	22·3	138·7	112·0	12·3	156·3	275·9
Average for men	35·2	126·4	76·7	8·6	155·2	189·0

In fact, they were above average on *a*, *b*, *c* and *d* and average on *e*. The evidence is inconclusive, but it is possible that the battery of tests gives an advantage to a left-handed person.

(*f*) *Association with time and place*

Some of the tests were done in the Road Safety Division of the Road Research Laboratory at Langley, others in the Materials and Construction Division at Harmondsworth. The change of surroundings made no difference to the mean scores as is shown in Table 2.

Some persons were tested in the mornings, others in the afternoons. The mean scores in each group indicate no significant difference (see Table 2).

Table 2

	Men		Women	
Description	No.	Mean	No.	Mean
Scientific grades (SO and above)	29	215·3	—	—
Technical grades (SEO, EO, AII)	16	211·0	2	200·8
Experimental grades (AEO, AIII, Temporary Appointments)	34	204·2	10	123·3
Assistants (Laboratory assistants)	32	189·4	6	132·9
Clerical staff	12	178·3	25	107·5
Skilled industrial staff	18	194·2	—	—
Unskilled industrial staff (messengers, labourers, etc.)	13	100·9	—	—
Left-handers	3	275·9	—	—
Non-drivers	13	184·6	9	116·2
Drivers	72	211·1	2	155·8
Tests in morning	87	186·8	31	113·8
Tests in afternoon	76	191·6	22	116·2
Tests at Langley	32	183·6	19	112·9
Tests at Harmondsworth	131	190·4	34	115·9
Total	163	189·0	53	114·8

N.B. The totals are not always additive owing to lack of information.

V. SUMMARY

1. Four mechanical aestheto-kinetic tests have been devised by the Industrial Health Research Board of the Medical Research Council for studying accident proneness. These tests have been tried out on 217 members of the staff of the Road Research Laboratory.

2. Men obtained better scores than women on all the tests.

3. The correlation matrix for men was hierarchical, but for women it was not.

4. The best linear combination of test scores had a correlation of 0·87 (for men) with some quality which is measured by all the tests.

5. The tests vary in their usefulness in measuring this particular quality, the direct triple tester being the best and the interrupted pursuit meter the worst.

6. Unskilled industrial workers have bad scores. There is a tendency for higher grade staff to get better scores.

7. Older men get worse scores.

8. Drivers get better scores than non-drivers.

9. There is apparently no relation between score and time of day at which the tests were done, nor between score and place of test.

10. Left-handed men possibly have better scores.

This note is published by permission of the Director of Road Research, and on the recommendation of the joint Committee on Road Users of the Road Research Board and the Medical Research Council.

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(*Manuscript received* 5 *August* 1949)

PUBLICATIONS RECENTLY RECEIVED

Law and the Modern Mind. By JEROME FRANK. London: Stevens and Sons. 1949. Pp. xxxv+368. 25*s.* net.

This is a most stimulating book which, having passed through six impressions in the U.S.A., has now been issued in this country. It is an attempt to overthrow the traditional mode of legal thinking, based on Platonic and scholastic foundations—what Judge Frank terms 'the basic legal myth' of the certainty and generality of the law—and to bring law within the framework of modern modes of thought as represented by such trends as pragmatism, relativism, and the naturalistic study of man and society. There is much to interest the social psychologist in the author's analysis of the realities of legal processes (in the account, for example, of the relation between the judging process and the personality of the judge), and in his explanations of legal traditionalism in terms of an emotional blockage which fosters the survival of childlike thinking. The book has the merit of being extremely readable. Though it is not systematic in its treatment, it is scholarly and fully documented in its references both to legal sources and to the writings of philosophers, psychologists and sociologists. Recent discussions and pronouncements in this country have revealed an unfortunate tendency for lawyers on the one hand, and psychologists and social scientists on the other, to misunderstand each other. This book should do something to bridge the gulf; it represents a very large move from the legal side towards developing 'the notion of law as a portion of the science of human nature'. L.S.H.

The Group Approach to Leadership Testing. By HENRY HARRIS. London: Routledge and Kegan Paul. 1949. Pp. x+288. 21*s.* net.

In 1941 the British Army was faced with a serious shortage of officers. It was apparent from the high rate of failure at the Officer Cadet Training Units, and the small numbers of other ranks who put themselves forward as candidates for commissions, that the Interview Boards responsible for selecting potential officers were neither picking out enough of the right people for training nor giving the impression that candidates were being carefully and sympathetically considered. In 1942 these Interview Boards were superseded by War Office Selection Boards which are believed to have made a much better impression on candidates and thus encouraged larger numbers to put themselves forward, while their ability to select potential officers, as indicated by failure rates and other follow-up material so far given in the very scanty publications, was no worse than that of the Boards they replaced.

So much is common knowledge, but two comments may be ventured. In 1942, when the present reviewer was acting as adjutant of an infantry battalion, an order was received from Higher Authority that 3% of the unit strength had to be sent to a War Office Selection Board forthwith. Misgivings were voiced as to whether the unit at that time contained twenty-four potential officers but these were treated with contempt by the aforementioned Authority, and that number of men were put on the train willy-nilly. Practically all were turned down, but this incident, if at all typical, may go some way to explain the increase in the numbers of candidates who 'came forward' for selection.

The second comment concerns the numbers handled by the War Office Selection Boards, which were very much larger and drawn from more diversified backgrounds than before. To achieve an equivalent rate of success in selection under these circumstances probably indicates a greater increase in effectiveness over the former Interview Boards than the mere figures suggest.

In this volume Dr Harris has given an account of his experiences and reflexions while serving as a psychiatrist on several War Office Selection Boards. From it the determined reader can piece together the procedure and its rationale, though his task is made more difficult by Dr Harris's predilection for referring to things by their initial letters. In some cases this is misleading, as when he uses IQ to mean Interests Questionnaire; in some cases it is inaccurate, for he refers throughout to PSO's when he means what, until 1945 at any rate, were MTO's; and in all cases it is irritating, for if he expects a reader to unravel a sentence like the following he should provide a glossary. 'A MATCOP whose CE is high, but whose GE is low may be quite unable to function on leadership level. An IMDEP or IMAG may, despite a personality handicap, have a sufficiently high GE to so function without serious strain or instability; though his GE will of course be correspondingly diminished.' The reader might then be able to deal with the lingering suspicion that the last GE is really a misprint for CE.

Dr Harris makes no secret of his belief that without the clinical experience of the psychiatrist such Boards would have been gravely handicapped. This view has apparently not been widely shared by the authorities concerned, who dispensed with the psychiatrists' services shortly after the end of the war. Psychologists seem to have rendered certain limited services in looking after some cognitive testing, checking educational standards and vocational requirements, and generally taking care of some of the paper-work. In terms of their usefulness to the psychiatrist, which appears to be the essential criterion of value throughout the book, they seem to have ranked rather below the sergeant testers (p. 228). Paper-and-pencil testing, of course, has its limitations in this type of selection work, but these are not quite so serious as Dr Harris's somewhat naïve conception of cognitive functions would lead one to believe (p. 55). In procedures where a more developed theory of psychometrics is accepted, the role of the psychologist has been rather different, and possibly more significant.

The author does well to stress the importance of the psychiatrist's clinical experience in the assessment of personality, otherwise the reader might be encouraged to attempt an ideational comprehension of the categories with which he works. In a chapter entitled 'The Projective Psychiatric Interview' he puts forward a series of concepts such as the individual's level of functioning, actual and potential, his attitudes to other people, objective or immature, and his affective balance as shown by the warmth, spontaneity and effectiveness of his behaviour. These could be put together into an adequate, though perhaps incomplete, theory of personality, on which reasonably objective assessments on a commonly accepted series of categories might become possible. There is, however, a joker in the pack. This is entitled 'stability', and on it there can be no common ground between those with 'clinical experience' and those outside the magic circle. 'Ratings on Stability are a matter for the medical psychologist.'

The book depends on theories of leadership which derive largely from Lewinian concepts, and the leader is seen as one who can promote co-operation as required by the Law of the Total Situation. It is curious that this conception, with its low valuation of competition and dominance by an individual, should have emerged in such a military setting. War is in its essence competitive, the aim of each side being to create a Total Situation to which the other cannot adjust without losing its integrity and effectiveness as a fighting force. Military commanders must, on occasion, resist the demands of the Total Situation, and those who are tempted to adapt themselves too readily to certain group pressures may find themselves in danger of being considered bad officers. Provided that enough time is taken to observe the candidates, however, and so long as the assessment of their potentialities is made the subject of rational discussion, it seems that satisfactory results can usually be expected from Selection Boards, no matter what the underlying theories may be on which they are conducted.

The years since the end of the war have seen an extended use of group procedures and other protracted methods in selection for higher appointments. Many nteresting problems are posing themselves, such as the reality-level to be aimed at in group sessions, the most economical and effective means of accumulating projective material from candidates, and the relation of the short-term intensive observation of them in the interview and group sessions to the longer-term extensive view gained in the biographical case-history. Dr Harris rather tantalizingly shows himself aware of these in incidental passages, but in general he neglects them in favour of what appear to be less essential and at times even trivial issues. It is a matter for regret that from the vast mass of case-material which these appointments put at his disposal he makes use of only one real or imaginary case as an illustration. And he reduces the value of this drastically by talking of a Scottish student gaining Matriculation. JOHN MUNRO FRASER

Experimenta Psychologica. By Edgar Rubin. Copenhagen: Ejnar Munksgaard. 1949. Pp. 356. Dan.Kr. 24.80.

This work is a collection of several of Prof. Rubin's papers in German, French and English, which appeared in different journals over the years 1920–38. The papers are arranged in two broad groups: those dealing with fundamental theoretical problems appearing in the first section, and papers of a more empirical character in the other. However, as the author points out, he has always striven 'to combine more fundamental theoretical views with the experimental point of view', and significant theoretical issues arise in each paper.

It will be recalled that another significant work, Rubin's *Visuell wahrgenommene Figuren*, when it appeared in 1921 as a translation from the Danish, provided much that was acceptable to the rising Gestalt school, both in respect of experimental findings and general attitude. The present volume also offers much that is stimulating to workers in the field of perception, and is not fundamentally at variance with the writings of the chief protagonists of this school. Rubin describes his fundamental viewpoint as

'adspektive'. The experienced 'object' is a resultant to which external conditions, 'inner psychological conditions', and stimuli from a variety of sensory modalities may contribute.

The several papers include observations upon, and the experimental treatment of, such topics as tastes, the perception of movement and a series of experiments under the general title 'Haptische Untersuchungen', which deal with the perception of forms by touch and movement. Appropriately enough, the volume concludes with a direct investigation of the possibilities of influence between two sensory modalities, the auditory and tactile, and some definite results of the inhibition of tactile 'shocks' by simultaneously presented sounds are given.

The volume makes possible a valuable general impression of Rubin's original and reflective approach to problems in fields where further work may still be done. F.V.S.

Applied Experimental Psychology. By Alphonse Chapanis, Wendell R. Garner and Clifford T. Morgan. London: Chapman and Hall. 1949. Pp. xii + 438. 36*s.* net.

A striking feature of this book is the extremely simple style of writing in which it conveys specialized technical information. It selects the salient points of experimental work on sight, hearing, movement and fatigue, and then shows the practical application of the findings in the design of machines (with their visual displays and controls) and of instruments used in communication. The sections on the arrangement of work, seating, movement study and fatigue summarize in the main the older work in industrial psychology, with some reference to the wartime research of 1939–45. Other sections deal with instrument dials and other visual displays, with radio-range signals and the more complicated auditory signalling systems for blind flying, and with the design of controls; and here, of course, the wartime work carried out in America and Britain is almost the whole story. The book is extremely useful as an introduction to this extensive field of practical work on the borders of physics and psychology. It seems doubtful whether the very simple writing is an advantage; one suspects that students capable of understanding the technical material would prefer to be addressed in a more grown-up style than the authors often use; for instance: 'Would all these tones then be equally loud? Long ago it was assumed that they would be, but later people interested in these problems decided to find out if it were really so. They did an experiment.' This is an odd style for readers who are expected to take in, from fairly brief statements, such specialized information as the differences between decibels, phons and sones. Nevertheless, the skill shown in selecting the main facts from a tremendous mass of recent experiment has produced a very competent introductory survey of a new field of work.

Adolescent Fantasy. By Percival M. Symonds. Columbia University Press (London: Geoffrey Cumberlege). 1949. Pp. xii + 402. 48*s.* net.

The author's central concern was to examine the validity of the material obtained by picture-story methods in the study of personality. This he hoped to do by comparing the stories and 'themes' derived from a group of pictures with the case data available for each of his subjects. Forty normal adolescent children, twenty boys and twenty girls, were used in the study. Stories were secured in response to a set of pictures drawn expressly for this project, each of which contained an adolescent character in some vaguely structured situation. Additional data obtained for each subject included reports of interviews with the child, his parents and his teachers, and autobiographies, questionnaires on interests and attitudes, pupil ratings by teachers and rankings for adjustment made independently by the author and his three assistant investigators. A conscientious account is given of the exhaustive analysis made of the stories obtained, including an inventory of themes, tables of norms, and a section on quantitative relations among groups of themes and relations between the themes and the other variables of the study. In the light of his extensive experience with efforts to work out objective methods for scoring the stories, the author's conclusion about the value of such methods should carry considerable weight: 'I am more than ever convinced that the value of a projective technique is lost by any attempt to analyse or score it psychometrically—its value resides in the degree to which the interpreter is able to build up from the trends and the themes in the stories a dynamically integrated picture of the individual being studied.' He is aware, of course, that interpretations derived in this way are subjective, governed as they are by the factors to which the experimenter is at the moment most sensitive; but this limitation, he suggests, may be one of incompleteness rather than of inaccuracy. In contrast with some workers in this field, who advocate blind analysis of the TAT, Symonds emphatically denies the possibility of deducing facts in the real life of the

subjects from their stories, and would emphasize that the proper purpose of the TAT and similar techniques in personality study is not to yield precise facts and information, but to reveal background motives and tendencies which help to show the meaning and motivational significance of other facts known about the person.

Perhaps the most interesting section of the book is a discussion of fantasy and character, which includes a comparison of the stories with the life-history material. There is a useful account of problems connected with the process of identification of the subject with the characters in his stories, and one rather startling conclusion made by the author is that sex lines are no barrier whatever to identification: 'Apparently boys can tell stories in which a girl is the hero as easily as those in which the boy is the hero—and vice versa for girls. Consequently there is no reason for having separate sets of pictures for boys and girls.' The author is refreshingly cautious in relating the fantasy material to the overt behaviour of his subjects. He found, for example, but a negligible correlation between the nature of the fantasy material and 'adjustment', and concludes that this would indicate that the picture-story method does not have diagnostic value, that is, does not help to distinguish between normal and pathological subjects. 'The same fantasies are produced by normal and by pathological individuals; this means that the same dynamic forces help to make a person normal that help to make him pathological.' It is difficult to find meaningful connexions between fantasy and overt behaviour, he adds, because these two forms of expression may parallel or oppose one another in a given individual. This relation in turn would seem to depend in each case upon the degree to which the fantasy need and the manifest expression of it are both expressions of some more general factor or disposition.

The section of the book which tabulates the norms for the themes obtained in the stories, although making a needed contribution to the literature in this field, may be of but little practical value to the English reader: e.g. many of the individual items may reflect the 'mom' culture in which American adolescents are often said to live. This objection does not appear to apply, however, to the full discussions given of two individual cases, one of a well-adjusted boy and one of a boy with delinquent tendencies; for here the interest lies in the relations that are traced among all the variables which were considered in an effort to obtain a 'dynamically integrated' picture of the two boys. The richness of these two pictures suggests that the author has been perhaps too modest in the claims for the value of his method.

M. POWELL

Adolescent Character and Personality. By Robert J. Havighurst and Hilda Taba. London: Chapman and Hall. 1949. Pp. x+315. 24*s.* net.

This is a contribution in the field of child development from a group of workers in Chicago University who co-operated in the intensive study of 144 sixteen-year-old boys and girls in a small self-contained community in the Middle West.

It is intensive rather than prolonged and its interest lies not in the details of its findings (since these are necessarily and admittedly relative to the Prairie City under observation), but in the clear and careful account of the research instruments used to determine and compare the character formation and the character reputation of the boys and girls under observation.

Character was understood in the sense of a composite of moral traits—that part of personality which is most subject to social approval—and the traits selected for special study were honesty, responsibility, loyalty, moral courage and friendliness.

Methods employed included check-list ratings and character-sketch matching by school teachers, employers, scout leaders and Sunday-school teachers, guess-who questionnaires filled in by other boys and girls, social status classifications, family-relations questionnaires, interviews, and assessments of sociometric status, intelligence, personal adjustment, interests and ideals.

Attention was given to the part played by social status, and by the standards and expectations of family, school, church and community; and discussion of the responses of the group was followed by case-studies of individuals classified as self-directive, adaptive, submissive, defiant and unadjusted.

The report as a whole is anecdotal rather than technical. No attempt is made to apply elaborate statistical techniques; but its record has value and interest for students of human development in its reminder both of the many influences contributory to character formation and of the complexity of the procedures ancillary to its adequate observation.

C. M. FLEMING

Children with Mental and Physical Handicaps. By J. E. Wallace Wallin. New York: Prentice-Hall. 1949. Pp. xxii+549. $6.35 net.

This is a valuable work, monumental in its scope yet detailed in its presentation. It presents the results of many years of extensive research into technical writings on mental and physical handicaps, their aetiology and sequelae. It is an authoritative work that should be of value to both medical and non-medical workers in the field of the mentally and physically handicapped.

Although it is primarily intended as a reference book, and comprehensive lists of references follow each section, Prof. Wallin draws so generously on his own long and rich experience in the fields of educational and clinical psychology that the work becomes itself a valuable treatise, developing and presenting a definite and somewhat novel point of view.

The author's method is to present historically and critically the available evidence in regard to each of his topics, and then add his own quota to the rest, and as one follows his devious argument through to the end, one becomes more and more aware of the great humanity of Prof. Wallin's point of view. Aware as he must be after 40 years of work among the handicapped, of the medical, psychological and social implications of the mentally handicapped child's plight, he yet advocates, with neither undue pessimism nor exaggerated optimism, research and more research, in the endeavour to prevent, relieve or mitigate the effects of disease and injury.

The book begins with an exhaustive study of the various definitions of mental defectiveness, and the author discusses such controversial questions as the relative importance of hereditary and environmental factors in the aetiology of various conditions, and here he criticizes adversely the newest and too optimistic school of environmentalists. The question of the constancy of the I.Q. comes in for some discussion with ample quotations from the literature; and the salutary effects in some cases of psycho-therapeutic measures on the I.Q. as well as on the child's educational status are considered and critically evaluated.

From mental deficiency the argument turns in chapter LV, to the relation of retardation to mental illness, and the problems of diagnosis caused by the great degree of overlapping of the two groups of patients. He rightly points out that the same subjects may be differently diagnosed by different examiners as unstable defectives, or as psychotic or psychopathic mental defectives, or as psychotics with mental deficiency. He gives as illustration the many varying opinions as to the causal relation between defect and mental disorder. In his discussion of schizophrenia he says: 'Schizophrenics of the simple type have often been sent to institutions for the feeble-minded under an erroneous diagnosis.' For the psychotherapist as well as for the diagnostician this is an important chapter.

Further sections deal with classification according to the psychological characteristics, educability and sociovocational competence of the dullard or dull normal. With chapter VIII the argument turns to classification according to aetiology, and so to a study in the second half of the book of special clinical types.

Later chapters describe the advances made in America (already having repercussions in this country) in the education and rehabilitation of the orthopaedically disabled, sufferers from cerebral palsy, and also poliomyelitis. These sections are informative and cover much that is new to British psychologists on the education and general rehabilitation of crippled children. The author stresses the importance of tentative psychological diagnosis in those cases of motor disability where speech is absent or defective. Chapters follow on hydrocephalus and syphilitic brain defects.

Throughout the whole work one finds this two-fold stress (and indeed this is opportune coming as it does from one who is an authority on the problems of the mentally handicapped), a stress on careful psychological diagnosis with a constant search for more adequate techniques, and also a stress on the need to search continually for means to relieve or mitigate, through education and psychological procedures, the sufferings of mentally handicapped children. It is this stress throughout that makes the book an outstanding contribution to psychological literature.

If there are minor defects these are mainly verbal and due no doubt to the wide field the author has attempted to cover within the confines of one volume, and are faults inherent in the need to condense. It would therefore seem illogical to mention an omission, but surely the problem of the deaf child (and to some extent the blind) might have found mention in this book on physical handicaps. These are mentioned only in passing and it would seem that the difficult problem of assessing mental status in the deaf child, and the danger of a wrong diagnosis of mental defect might properly have been included in this volume. But whatever criticisms may be offered this further volume from Prof. Wallin is undoubtedly one that no psychiatrist, clinical psychologist, educationalist, or psychotherapist can afford to overlook.

RUTH GRIFFITHS

The Mental Life of the Child. By Gustav Hans Graber. London: Staples Press. 1949. Pp. iv+158. 8*s*. 6*d*. net.

This description of the methods of a child analyst contains valuable case material. The style, particularly in the introduction, is too metaphorical: this is no doubt partly due to the intangibility of the ideas to be expressed, but leaves one with a distrust of their validity. It would be valuable to know how the children were selected for treatment, as the degree of insight and co-operation described would be beyond many maladjusted children.

The book gives a sympathetic and fairly comprehensive account of the deep mechanics of childish behaviour, though we may doubt, here as elsewhere, the wisdom of some of the interpretations offered to the children.

A.M.S.

Living Through the Older Years. Edited by Clark Tibbitts. Michigan University Press (London: Geoffrey Cumberlege). 1949. Pp. xii+194. 16*s*. net.

A collection of addresses given at the 'First attempt to hold a comprehensive conference on problems and adjustments in later maturity and old age' in America. The eleven addresses which comprise the book are given in a semi-popular, not highly critical, and often anecdotal form; and relate, in general terms, the biological, social and psychological aspects of ageing to older peoples' problems of adjustment. The general level of the whole is that of a friendly mentor who, while not extending nor presenting in definitive form our field of knowledge on the subject of ageing, gives reassurance against anticipated problems, as well as underlining the social and biological factors involved.

The subjects covered by the several speakers include: maintenance of health, older parent-child problems, hobbies, religion, general adjustment, ageing and employability, while there is a clear discussion on the economic basis of assistance programmes, and a really practical discussion on living arrangements for older people. There is also one chapter of some twenty pages on 'Changes in Psychological Processes with Ageing', of which some eight pages are devoted to a discussion of experimental findings. Sources, though often recognizable, are not given, and this chapter, like others, could have benefited by the inclusion of references.

Lack of co-ordination of material is perhaps inevitable in any symposium of this kind. In the present instance it has led to a good deal of repetition both of specific items and general topics. This should not be judged too harshly, as it is symptomatic here of the dearth of real knowledge on the subject.

D. SPEAKMAN

The Clinical Application of Psychological Tests. By Roy Schafer. New York: International Universities Press (London: George Allen and Unwin). 1949. Pp. 346. 30*s*. net.

The present trend in clinical psychology in this country appears to be towards using larger and larger batteries of tests on more and more people. This trend may have at least two unfortunate consequences: first, the introduction of tests into the battery, which, though of proved reliability, are of unproven validity and of doubtful significance; secondly, the delegation of tests to untrained personnel. The psychologists at The Menninger Foundation prefer to rely on a relatively small battery of tests which they consider to be of real significance and to extract from them the maximum information. The second great merit of the book is that complete protocols are presented for typical examples of most of the chief nosological groups and these are followed by the psychologist's full interpretation.

Despite the fact that the tests in the Menninger battery (Wechsler-Bellevue, Learning Efficiency, Sorting Test, Word Association, Rorschach, T.A.T.) have achieved a certain venerability (not all, in the present reviewer's opinion, justifiably), the interpretations occasionally suggest that there has been too much raking among the ashes. Can the fact that the Digit Span score does not drop really reflect the *blandness* of the psychopathic character disorder (p. 54)? Can the fact that Information is two points below Vocabulary really suggest some weakness of application in this respect—perhaps superficiality of interest and poor integration of achievements (p. 110)? Or could it suggest that it is dangerous to attempt to draw very subtle conclusions from the answers to twenty-six questions designed to sample the whole range of human knowledge? One suspects that the author often projects into his interpretations clinical impressions formed independently of the tests. One also suspects that these clinical impressions are probably right.

The cases presented are intended to be unequivocal examples of particular illnesses. To many clinical psychologists the Schizophrenics may appear relatively unflorid. The description of the Narcissistic character disorders (p. 46) scarcely seems to provide an adequate differentiation from hysteria (p. 32).

Finally, this very useful supplement to *Diagnostic Psychological Testing* should serve to remind us that Clinical Psychology in the adult field is still grossly neglected in Britain. G.A.F

Case History in Abnormal Psychology. Assembled by CALVIN P. STONE. Stanford University Press (London: Geoffrey Cumberlege). 1949. Pp. 106. 10*s.* 6*d.* net.

Dr Stone's purpose is 'to provide an inexpensive source of illustrative cases which students may study before, and along with, assigned readings in any standard text-books in abnormal psychology'. For approximately twice the present price the student could obtain the standard British text-book of psychiatry, which includes more case histories than are presented here.

The book opens with a very brief section on Primitive Beliefs, e.g. 'when a devil possesses a man, or controls him from within with desease, a spew-drink of lupin, bishop's-wort, hensbane, garlic; pound these together add ale and holy water.' It is difficult to determine whether or not the juxtaposition of this and subsequent sections is intended ironically. The remaining sections are, however, somewhat less primitive—despite the fact that 44 % of the cases are extracted from books published prior to 1930.

The desire to include every type of case has resulted in an emphasis on rare cases misleading to the student who attempts to use the book before embarking on a guided course of study. It might be used with profit after such a course. G.A.F.

Clinical Psychology. By CHARLES BERG. London: George Allen and Unwin. 1948. Pp. 503. 25*s.* net.

Dr Berg is a psycho-therapist whose talented writing in his previous books has brought him a wide recognition amongst laymen. This book, however, is clearly intended for a different audience; apparently, in the first place, for his psychiatric colleagues who have not got the insight into the unconscious mind that he would like them to have. In his autobiographical introduction, the author indicates his own experiences of the limitations of reading as a method of gaining such insight and the necessity of having personal analysis. Presumably he hoped that by presenting more of his work to these colleagues he would persuade them to proceed to the real training.

The title of the book would suggest a reasonably comprehensive presentation of the field of personality and the behaviour disorders, and their diagnosis and treatment. In fact, most of it is devoted to a series of sketches of the psycho-pathology of the neuroses, illustrated with case studies and followed by a review of treatment methods. Amongst these, the author singles out psycho-analysis for most attention. The case material is extremely well presented and he has the outstanding merit of trying to convey the details of what actually happens in the therapeutic sessions instead of giving the common summary type of statement that 'such and such a theme was interpreted'. In this way he succeeds in conveying a good impression of some of the unconscious dynamics in the patient-doctor relationship. He is much less at home, however, in his general remarks on the principles underlying psycho-analytic treatment. Despite the fact that he professes to expound psycho-analytic principles—and his clinical work is intended to be based on these—his exposition of them would certainly not be accepted by psycho-analysts. For instance, hardly any psycho-analysts would speak to-day of a 'pre-transference stage' in treatment, or find difficulty in conceiving, as the author does, how the negative transference and resistance can be analysed from the start without waiting to build up a positive transference. The importance of this point does not lie solely in its practical implications. Psycho-analytic theory of the personality and its disorders is based on the full grasp of the concepts associated with transference phenomena. It is this incompleteness in much of the exposition of psycho-analytic theory that raises doubts about the audience that will be satisfied by this book, for many of our younger psychiatrists have now some intellectual knowledge of psycho-analysis. Mrs Klein's work is not unknown amongst them, yet it receives here such meagre incorporation into the psycho-pathology that her name does not even appear in the index.

Apart from these deficiencies in the presentation of the work of the psycho-analysts, there are some other conspicuous omissions. For instance, one looks in vain for any reference to modern psycho-diagnostic methods such as might have been expected in a book of this size and with this title. (The gap between writing (1945) and publication (1948) has unfortunately made the references to group therapy sadly out of date, though the author can hardly be blamed for that.)

Dr Berg's drive to proselytize has resulted in a very readable volume. But his assets for missionary work do not quite meet the demands for the rigorous thought and comprehensive knowledge that the production of a text-book imposes. J.D.S.

Mysterious Marriage. By E. Graham Howe. London: Faber and Faber. 1949. Pp. 320. 15*s.* net.

This book is a study of compulsion neurosis, consisting of short case records, reports of interviews with patients and expositions of the author's interpretation of his clinical observations, and his views as to the origin and development of the compulsion-obsessional syndrome.

The case records are vividly written; some of them, such as that describing the inner fantasy life of a young man Michael, may be called literary gems. The psychiatric interviews are equally well told. In them dreams are analysed and the subjects' comments elaborated.

These clinical notes are not the product of one patient, but of many, and they are so well constructed that they hold the reader's interest and arouse the imagination.

The book is, as the author points out, the child of experience, wedded to imagination, but the real meaning of the title is the mysterious marriage between the 'I' when the man is god-like, and the 'me', the mortal creature, and the creative partnership between that and an unknown factor, a force outside the self. 'If you throw a stone, its trajectory can be calculated, but not so if you throw a cat'—this is the unknown factor, the life force, or God, perhaps.

On first acquaintance, the style of the book may be found difficult to follow; the writer himself styles some parts as 'dream-like and allegorical'. And to the orthodox psycho-analyst the specific negation of mechanistic determinism may seem disturbing, but on a second, or even a third reading, the background of observation and sympathetic understanding are so disarming as to be convincing. Here is, at least, a new point of view.

There is so much of interest in this book that it is hard, in a few words, to expound its essence but, basically, the idea is that in compulsion neurosis there is interference with human relationships.

Normally, awareness should flow smoothly from the life stream, through unconscious levels, and feelings, to the 'me', the present consciousness, the centre of past and future, and then should lead to appropriate action in the external world of reality. In the obsessional, this process is blocked by conflict on the unconscious level, absence of feelings, leading to mental conflict on the 'me' level, and indecision instead of action; and, moreover, the real world is not seen clearly. The result is usually an attempt to solve the conflict by identification with 'good objects' in the outer world, and a repression and fixation on the unconscious level with 'good images', and identification with them. There is therefore a splitting on the reality plane.

The disturbance shows itself mostly in social relations. The obsessional is satisfied with nothing short of identification and 'the other' must change to suit a set pattern—there can be no freedom for 'that other', it is all or nothing. Dr Howe shows how this possessive compulsive attitude influences relations between parent and child, and husband and wife, and that it enters into family life at all levels, and into national and even international affairs. He believes that everyone is tinged, more or less, by compulsion neurosis, and that it is inborn often, but aggravated by environmental influences during development. The inborn factor is responsible for the difficulty of its treatment.

This book can be thoroughly recommended to all serious students of humanity. It will give them food for thought, and may also enable them more fully to appreciate the effects of the compulsions they see around them, and maybe also to recognize their existence in themselves. WILLIAM MOODIE

Hamlet and Oedipus. By Ernest Jones. London: Gollancz. 1949. Pp. 168. 12*s.* 6*d.* net.

Papers on Psycho-analysis (fifth edition). By Ernest Jones. London: Baillière, Tindall and Cox. 1949. Pp. viii + 504. 31*s.* 6*d.* net.

Hamlet and Oedipus is an expanded form of Dr Jones's well-known essay on Hamlet, one of the most convincing and influential psycho-analytic contributions to the criticism of the arts. The additional material includes discussions of the pre-Freudian theories of Hamlet's delay, and of earlier versions of the Hamlet story and its relation to other myths. There are also new sections extending the psycho-analytic discussion of the theme. Wertham's valuable suggestion of the parallel between Hamlet and Orestes (and its bearing on Hamlet's hostility to his mother) is discussed, though too briefly; Rank's analysis of *Julius Caesar* as another expression of the Oedipus situation is also summarized. On the whole the new material

adds only a little to the value of the essay and offers many invitations to scepticism on points of detail: but it is useful to have a considered presentation of the whole theme in an accessible form.

Dr Jones says that the fifth edition of his *Papers on Psycho-analysis* 'should be positively the final edition of this book'. Nine recent papers are added and fourteen from the fourth edition omitted, and Dr Jones says that a possessor of all five editions will find that it comprises eighty-nine papers. This is not a satisfactory method of publication if all eighty-nine are worth having; if they are not, one would have liked to know that the twenty-seven here printed, ranging in date from 1909 to 1947, had been selected for their relative importance. It seems hardly likely that this is so, since some are technical discussions of theory (e.g. 'The Theory of Symbolism' and 'Psycho-analysis and the Instincts') and others (such as the brief account of 'The Genesis of the Super-Ego', and the paper on 'Psychology and Child-birth' read before a midwives' association) are rather simple expositions of familiar ideas.

Ueber psychische Energetik und das Wesen der Träume. By C. G. Jung. Zurich: Rascher. 1948. Pp. 314. Sw. fr. 15.50.

This book is an enlarged and revised edition of the original *Ueber die Energetik der Seele* (Zurich, 1928, pp. 224). It contains the original four contributions of the first edition, and two new essays, 'Allgemeines zur Komplextheorie', a lecture given on the occasion of Jung's inauguration as Professor at the Eidgenössische Technische Hochschule in May 1934 (published as a pamphlet, Aarau, 1934), and 'Vom Wesen der Träume' (published in *Ciba-Zeitschrift*, July 1945). The revisions of the four older papers are only of minor importance, except for one to be mentioned later. Most of these four papers have been available in English for many years ('The Psychology of Dreams'—an incomplete version of 'Allgemeine Gesichtspunkte zur Psychologie des Traumes' in *Collected Papers on Analytical Psychology*, and 'On Psychical Energy', 'Instinct and the Unconscious', 'The Psychological Foundations of Belief in Spirits' in *Contributions to Analytical Psychology*). For this reason the present review proposes to deal almost exclusively with the two additional essays which are not yet available in English.

'Allgemeines zur Komplextheorie' ('General Remarks regarding the Theory of Complexes') is essentially a restatement of the theory of complexes as given in the paper 'On Psychical Energy'. Jung discusses the experimental situation (of the association experiment) which led to the discovery of 'emotionally-toned complexes', possessing their own specific energy. He re-defines the complex as 'the image of a particular psychic situation which is vividly emotionally-toned and at the same time incompatible with the habitual conscious level and attitude'. This 'image' is characterized both by strong inner coherence and a high degree of autonomy. These characteristics give the complex the properties of a partial personality, and in dreams complexes appear personified. Complexes can be regarded as 'dissociated partial psyches' ('abgesprengte Teilpsychen'), the dissociation being produced by traumata, moral conflicts, etc. The more unconscious the complex, the more powerful it is, and it may display a remarkable 'power of assimilation', sometimes leading to assimilation of the ego. This may produce a temporary and unconscious alteration of personality or 'complex-identity' (which explains phenomena like 'demons' or 'possession').

The development of 'ego-consciousness' (i.e. the higher intensity of the 'ego-complex') leads to the attempt to deny the power and autonomy of the complexes until they prove their reality in the neurotic dissociation of personality. The modern attempt at 'irrealization of the complexes' ('Komplexirrealisierung') proves, however, not their non-existence but on the contrary their power. 'Complex-irrealization' is born out of the instinctive fear of dark, invisible and autonomous forces. But complexes are not at all pathological; they are specific psychic manifestations, 'living entities of the unconscious psyche'. The general fear of complexes is an indication of the fear of the unconscious, as the psychic focus of 'unrest'. Modern psychology, with its exploration of complexes, has touched upon a taboo laid by ego-consciousness on the psychic 'numinosum' and 'tremendum'.

Since the publication of the essay 'Allgemeine Gesichtspunkte zur Psychologie des Traumes' in 1928 (of which a small preliminary part was published in *Collected Papers* in 1916 as 'The Psychology of Dreams') Jung's theories of the collective unconscious, the archetypes and the process of individuation have undergone a constant development. This development—as far as it concerns the psychology of dreams—is presented in highly condensed form in the new essay 'Vom Wesen der Träume' ('On the Nature of Dreams'), first published in 1945. Jung restates both his indebtedness to Freud's discoveries and his criticism of them. His criticism is in particular concerned with the one-sided Freudian theory of dreams as wish-fulfilments. He regards dreams as autonomous manifestations of the unconscious whose main function is that of compensation (or correction) of a too narrow or one-sided attitude of the conscious mind. Treatment of neuroses is fundamentally the task of restoring a disturbed harmony between the conscious and the unconscious psyche.

The compensatory function of dreams reveals in time a more comprehensive meaning as representing a process of the personality's inner development, the process of individuation. Jung distinguishes between 'small' and 'great' dreams, the 'small' one deriving mainly from the layer of the personal unconscious, the 'great' ones, however, from that of the collective unconscious. These latter ones, with their archetypal images, are the typical manifestations of the process of individuation. Archetypal images and motives are particularly prevalent in decisive phases of life, i.e. in early childhood, puberty, the middle of life (about 36–40), and 'in conspectu mortis'. They represent stages of the process of individuation, with the final aim of 'integration of the unconscious into consciousness, or more correctly, of the assimilation of the ego into a more comprehensive personality' (this latter would be the 'self').

Jung goes on to discuss the structure of dreams which he compares to that of the drama. He distinguishes four phases: that of the exposition (indication of place, dramatis personae, time, etc.), of the plot (the complication), of the culmination or peripety, and of the final lysis or solution showing the result of the dream-activity. Finally, Jung gives warning against an exaggerated valuation of the unconscious, as if it could give the answer to every tangle. Consciousness is not just a 'lusus naturae', but a necessary development beyond unconsciousness. The proper function of the unconscious lies in its co-operation with, and compensation of, the conscious mind.

Of the revisions and additions to the original essays one is of particular interest. This is the addition of something like three pages to the last essay on 'Die psychologischen Grundlagen des Geisterglaubens' ('The Psychological Foundations of Belief in Spirits', first published in 1919). From Jung's words it is clear that his attitude to 'psychical' phenomena has become much more positive. On the basis of his observations he seems prepared to accept the reality of certain 'parapsychological' phenomena. Whereas in his original essay he felt no need to attribute to parapsychological phenomena a special place outside psychology, he says in 1947: 'I doubt now whether exclusively psychological methods and considerations can do justice to these phenomena. Not only the results of parapsychology but also my own theoretical thoughts... have led me to certain postulates which touch upon the realm of atom-physics, i.e. the space-time-continuum. The question of the transpsychic reality, which is the direct foundation of the psyche...is thus posed.'

GERHARD ADLER

Selbsterhaltung und Selbstheilung. By A. Maeder. Zurich: Rascher. 1949. Pp. 336. Sw. fr. 15.

The basis of this book consists of lectures which Dr Maeder gave at the University of Zurich during the years 1945–7. Its central theme is that of the tendency of self-preservation and spontaneous curative forces in the psychic processes. The author distinguishes between the autonomous, unconscious activity of the psyche as the manifestation of its immanent primal vital force, and the arbitrary conscious activities adding an individual factor to this immanent force. The purpose of the book is to examine the interaction and interdependence of these two psychic activities. The particular emphasis of this book is on the spontaneous curative, self-preserving faculties in the psyche (and for this reason it will be supplemented by a later book dealing more specifically with the 'conscious activity' of psycho-therapeutic practice).

Dr Maeder discusses first the general foundations of modern psycho-therapeutic methods. He acknowledges the great debt of modern psycho-therapy to Freud, but at the same time he tries to find a synthesis between the psycho-analytical approach and the discoveries of Jung. The latter have influenced his outlook to a large extent, in particular Jung's synthetic-teleological approach, in contradistinction to the causal-mechanistic approach of psycho-analysis.

The main part of the book deals with the spontaneous psychic tendency towards 'auto-regulation' and self-regeneration. The author examines certain biological parallels of regeneration which he defines as an urge towards wholeness. From there he proceeds to the examination of the function of such psychological phenomena as spontaneous thoughts, intuitions, play, fantasy, and dreams. He discusses them in particular from the point of view of their prognostic value.

The self-curative process is illustrated by an interesting analysis of the autobiography of the sculptor Benvenuto Cellini. The book is a helpful—though slightly repetitive—presentation of the final-teleological approach to psychological problems.

GERHARD ADLER

Psycho-Analysis: a Modern Delusion. By Frank Kenyon. London: The Pioneer Press (for the Secular Society). 1949. Pp. viii + 141. 5*s.* net.

In an atmosphere of nineteenth-century free-thinking, this book attacks psycho-analysis for its support of the view that the mind is distinguishable from the body, for its faulty logic and for its defects of scientific

method. The arguments and objections are the familiar ones, put cogently and well illustrated. Positively, the book offers a simple materialist account of psychological facts, with full reliance on the usual kind of physio-fantasy. Thus, of any form of insanity which seems to lack organic explanation the author writes: 'The malady in question is undoubtedly due to *some* physical condition: quality of the blood; excess or deficiency of blood supply; defective metabolism; maladjustment of nerve-fibres; imperfect organization and co-ordination of tissue, muscle, and nerve; any of which, while not materially affecting the *structure* of the brain, may affect it considerably in its *functions*. Disordered function, long continued, may give rise to cerebral lesions and, if these are not discovered, it may be that they are operating beyond the limits to which microscopic and chemical examination have yet attained.'

The hostility of free-thinkers such as Mr Kenyon to psycho-analysis deserves attention. Apart from the defects of logic and method to which he rightly objects, it looks as if one root of his antagonism is the belief that psycho-analysis tries to invalidate rational thought. 'Reason', he says, 'is regarded, not as a guide to conduct, but merely as an instrument to provide justification for the expression of unconscious, instinctive desires.' The book is of some interest, therefore, as a reflexion of the psycho-analysts' failure to show the general public effectively that they recognize a distinction between rationalization and reasoning, and that their work enriches the materials without invalidating the process of rational thought.

Geniale Menschen (Fourth edition). By Ernst Kretschmer. Berlin: Springer. 1948. Pp. v+217. DM. 18.60.

Geniale Menschen the first edition of which was translated into English under the title of *The Psychology of Men of Genius* was regarded as the most interesting approach to the problem of genius that had appeared up to date. Its thesis is too well known to require repetition at this stage. However, it is interesting to note that his advocacy in this book of the mating of mixed strains and the implied condemnation of pure-racial theory nearly landed Kretschmer in a concentration camp.

In the third edition Kretschmer included new material dealing with Paracelsus, Behrin, Linnæus and Moltke. In this edition he has added to, or introduced for the first time, matter dealing with Calvin, Bismarck, Goethe, Mörike and D. F. Strauss.

May this sane, courageous and original book once more enjoy the success that it deserves: and it is to be hoped that a second English edition, i.e. a translation of the fourth German edition, will be given to us by some enterprising publisher. E.B.S.

The Origin of Genius. By Alfred Hock. Published by the author (105 Murray Street, Binghampton, N.Y.). 1949. Pp. 67.

The Origin of Genius by Alfred Hock is a translation from the German. The author does not regard inherited constitution, which may or may not be psychopathic, as of ultimate importance in the genesis of genius. He observes that the effort invested in the attainment of a set goal is of equal importance. He says that 'he who wants to discover a new truth must be capable of the strictest abstinence and renunciation'. 'Thus, to become a genius is by no means to be doomed by fate, nor does the psychopathy of genius constitute a danger for progeny.' This is an interesting little monograph which would well repay study and reflexion. E.B.S.

Albert der Grosse: Gedanken über sein Leben und aus seinen Werken. By Rhaban Liertz. Munster: Regensberg. 1948. Pp. x+245. DM. 10.80.

It is common enough to read enthusiastic accounts of the life and work of the great or near-great who have recently died, written by their surviving friends and pupils; this, however, is something different, a book dedicated to his beloved teacher, nearly 700 years dead, by his grateful pupil and interpreter, living to-day. A German of the twentieth century, who has twice seen his country defeated after a mad struggle for the mastery of Europe, hopes that it may find consolation and guidance in studying the work of a great German scholar who lived through nearly a century of strife and horror, a century which also saw the flowering of great art and the first dawn of modern science. This is not mere escapism, for the author writes as one would of a contemporary; in his eyes Albertus Magnus belongs to all times and all peoples, though particularly to the Germans, who are most in need of his healing. 'Greater than the governor of a city', wrote Albertus, 'is the man who governs himself'.

The book falls into two parts, the first a description of the life and works of Albertus, the second a number of extracts from his books classified and arranged under headings: Albertus as naturalist, as philosopher, as one who understood men, as theologian, as teacher and as trainer. The author has already, it seems, produced a book on Albertus as statesman, so that aspect is not treated here. The section ends with a collection of aphorisms and short sayings such, for instance, as: 'Do not strive to become pure spirits but set your mind to being good men.' 'Do not be always talking about degeneration and inherited burdens; there are also estates and individual recovery.' 'There are two roads to knowledge of the truth, the natural way of reason and the supernatural way of revelation.'

The author's contribution comprises an introduction explaining the particular relevance of a revived study of the life and works of Albertus to the needs of the time, a table of dates of important events in his life, a description of the memorial tablet in Cologne Cathedral where he was buried, and a detailed discussion of his life and teachings. The tablet is interesting; 'Phoenix among scholars, the incomparable Albertus,... in wisdom greater than Plato, scarcely less than Solomon,...'. This is high praise, even on a memorial tablet, but perhaps his friends remembered him not only as a great man but as a serene, warm-hearted, modest individual whom they could both revere and rejoice to know. He must surely have been the only empirical scientist to be canonized, even though his scientific work may not have been the reason for that honour.

The author has studied the writings of Albertus over a period of twenty years, and for one reader at least has succeeded in writing with such warmth and intimacy that he makes a living personality of his subject. 'Für uns ist Albert nicht gestorben.' Hitherto, for many of us, he has been known only as the teacher of Thomas Aquinas, who succeeded in diverting the main interest in Catholic philosophy from Plato to Aristotle. Albertus had a reverence this side idolatry for Aristotle. ('Aristotle is not a god and may be mistaken just as we ourselves'), and undoubtedly his teaching influenced his illustrious pupil, but one cannot but feel that his own interests had a much wider range; in short, if they both came alive to-day, Albertus would have more to give a world sorely in need of a humane scientist who was not preoccupied in contriving trivial or deadly gadgets. He had been brought up in the country and his first love was natural history, but great as was his contribution to science he was no specialist. When Latin was the universal language of educated men, he made a study of the German dialects spoken by the simple folk to whom it was his duty to preach, so that they might understand the simple words he used; in this way he laid a foundation for a standard German. The friend and intimate of great scholars and princes did not rate himself higher than the humblest of men. Was not he himself a sincere member of a begging order?

M. COLLINS

The Tibetan Book of the Dead. By W. Y. Evans-Wentz. Oxford University Press. 1949. Pp. 1+248. 18*s.* net.

This translation of one of the sacred books of Northern Buddhism deals with the forty-nine days after death, during which the individual awaits rebirth. The visions he then sees are largely determined by the state of being that his previous existence has produced, but they are also influenced by the quality of his preparation for the experience and by the religious directions which his *guru* can give him at the moment of death and during the interval prior to rebirth. The object of the book, and of the rites and instructions it describes, is to enable the dead person to understand that the visions he sees are products of his own mind, to be less terrified in consequence, and to do what he still can towards securing a favourable rebirth.

The emphasis on the subjective origin of the visions and other experiences attributed to the individual between death and rebirth provides points of contact between these religious beliefs and some of the views of western psychologists, especially those concerned with the collective unconscious. The editor draws attention to some of the parallels. But the book is chiefly valuable as a document of one of the great religions. Those who are occupied with the psychology of religion will be glad to have this translation and the editor's useful introduction and commentary.

Body and Mature Behaviour: A Study of Anxiety, Sex, Gravitation and Learning. By M. Feldenkrais. London: Routledge and Kegan Paul. 1949. Pp. viii+167. 12*s.* 6*d.* net.

This book consists of 163 pages with an index, but no bibliography. It is too short for a technical treatise and too technical for a popular review. The lack of a bibliography is to be deplored, as the reader is left in doubt as to when the author is making an original contribution, and when he is quoting the views of

others. The views propounded in the chapter on 'Muscular Habit and the Sexual Act' bear a resemblance to those expressed by Wilhelm Reich in 'The Function of the Orgasm', and the phraseology in parts is reminiscent of that of F. M. Alexander in 'The Use of the Self'.

Those without physiological knowledge will not trouble to read this book, and those who have it could well have been spared much technical detail. The author appears to have some knowledge of Judo, and his remarks on the mechanical advantage of the erect posture for motility are new to the reviewer. It would have been interesting to have had this subject expanded with examples from the practice of Judo.

DUNCAN WHITTAKER

The Mental and Physical Effects of Pain. By V. C. Medvei. Edinburgh: E. S. Livingstone. 1949. Pp. 59. 3*s*. net.

This is a brief essay on pain, bringing together the problems raised and the main theories proposed by previous workers, chiefly medical men and neurologists. It is rather poorly organized and its arguments seem inconclusive. It has value as a reminder of the difficult problems still to be solved before pain is understood, and in particular the obscure relation between the anatomically traceable structures involved in pain and the total experience. Although it does only a little to clarify this problem the essay restates it and brings together (with a useful list of references) much relevant material from recent medical writings.

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